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South Tahoe Public Utilities District, South Lake Tahoe, CA

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SOUTH SHORE [illegible] TAHOE BASIN

SOUTH TAHOE P[illegible] DISTRICT, CAL[illegible]
DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT [illegible] NEVADA

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The draft environmental impact statement investigates the secondary impacts of expanding and improving the two wastewater treatment facilities that serve the south shore of the Lake Tahoe Basin. The statement describes five alternative growth scenarios which are used to assess the impacts on both the natural and manmade (social) environments. These technical appendices provide background and supporting information for the material contained in the draft environmental impact statement.

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TECHNICAL APPENDICES

DRAFT ENVIRONMENTAL IMPACT STATEMENT

SOUTH TAHOE PUBLIC UTILITIES DISTRICT
AND
DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. I

PROPOSED WASTEWATER TREATMENT FACILITIES

El Dorado and Alpine Counties, California
and
Douglas County, Nevada

Lead Agency: U.S. Environmental Protection Agency

Responsible Official: Paul De Falco, Jr., Regional Administrator
U.S. Environmental Protection Agency
Region IX
San Francisco, California

For Information Contact: Dave Jones, Janet Rosati, or Val Danos
U.S. Environmental Protection Agency, Region IX
215 Fremont Street
San Francisco, California 94105
(415) 556-2766, 556-8043, or 556-3040

Comments: Comments regarding this environmental impact statement should be sent to Janet Rosati (address above) by February 22, 1980.

ABSTRACT: The draft environmental impact statement investigates the secondary impacts of expanding and improving the two wastewater treatment facilities that serve the south shore of the Lake Tahoe Basin. The statement describes five alternative growth scenarios which are used to assess the impacts on both the natural and manmade (social) environments. These technical appendices provide background and supporting information for the material contained in the draft environmental impact statement.

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A. GROWTH SCENARIOS METHODOLOGY

1. PURPOSE

This appendix describes the methodology used to develop quantitative descriptions of the growth scenarios for STPUD and DCSID (as summarized in Table 7 in the text of the EIS). Included are descriptions of the definitions, assumptions, and analytical procedures used to quantify employment, population, housing, and land use for the 1978 baseline and for the five growth scenarios for future years (1990 and 2000).

This methodology is based on the approach and key assumptions regarding the major factors influencing growth in STPUD and DCSID described in the text of the EIS (see particularly Tables 5 and 6 and corresponding text).

2. EMPLOYMENT

Appendix Table A-1 describes summer employment in the south shore.

Employment estimates for 1978 were developed based on the most current, available data and relationships between gaming and other economic activities. Recorded employment statistics could not be used directly since they are available on a county-wide basis (south shore includes portions of two counties) and the most current, available figures (at the time scenarios were prepared) were for 1977. Long-term relationships developed for estimating employment had to be adjusted to reflect the recent opening of the Park Tahoe Casino which had not reached its full operating level in 1978.

Employment estimates for future years were based on evaluation of the existing and long-term relationships as described in the sections which follow.

GAMING

Gaming employment was estimated as a function of gaming floor space. Due to the seasonal fluctuations of patronage and employment, separate ratios were calculated for summer and winter. The assumption underlying these ratios is that the measured relationship of employees to floor space reflects a reasonably profitable situation (if not the most profitable).

TABLE A-1

TREES GROWTH SCENARIOS
SOUTH SHORE EMPLOYMENT (000)
(Summer)

		SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	1978	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
GAMING	9.4	9.9	9.9	9.9	9.9	12.5	12.5	12.5	15.6	12.5	15.6
HOTEL/MOTEL	2.1	2.5	2.5	2.7	2.8	3.2	3.3	3.2	4.0	3.2	4.0
AGRICULTURE/ MANUFACTURING	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
SERVICE AND CONSTRUCTION	9.9	12.3	12.3	13.1	14.6	13.7	15.1	13.7	15.9	14.9	18.1
TOTAL	21.6	25.0	25.0	25.9	27.5	29.7	31.2	29.7	35.8	30.9	38.0
GROWTH FROM 1978	N/A	3.4	3.4	4.3	5.9	8.1	9.6	8.1	14.2	9.3	16.4
PERCENTAGE GROWTH FROM 1978	N/A	16%	16%	20%	27%	37%	44%	37%	66%	43%	76%

The use of these ratios for future years assumes that this relationship will continue to be reasonably optimal.

Relevant to the development and use of ratios is the following:

- Ratios used for the scenarios:

  Summer Season: .052 gaming employees per square foot of gaming floor space;

  Winter Season: .037 gaming employees per square foot of gaming floor space.

- Ratios do not include casino employees working in casino hotel operations.
- Ratios are based on 1974 data for the largest casinos in the south shore (Harrah's, Sahara Tahoe, and Harvey's Resort). (Sources of data and information include: ERA 1976, Table 46; TRPA 1977a, Table 1; and conversations with CTRPA staff.)
- It is likely that over time (particularly for the lower growth scenarios) off season patronage levels will gradually increase. As this occurs, annual average employment will tend to rise toward summer employment levels.

Gaming employment estimates for 1978 and for the three levels of casino development assumed for defining growth scenarios are shown below and summarized for the summer season in Appendix Table A-1. Estimates for 1978 assume that the Park Tahoe Casino was at three-fourths of its full operating level.

	SOUTH SHORE GAMING EMPLOYMENT	
CASINO ASSUMPTION	Summer	Winter
1978 (Equivalent of 180,000 Sq. Ft.)	9,360	6,660
Low Expansion (Equivalent of 190,000 Sq. Ft.)	9,880	7,030
Medium Expansion (Equivalent of 240,000 Sq. Ft.)	12,480	8,880
High Expansion (Equivalent of 300,000 Sq. Ft.)	15,600	11,100

HOTELS/MOTELS

Hotel/motel rooms and associated hotel/motel employment were estimated as a function of gaming activity and other recreation activities. The relative importance of gaming and other recreation activities was assessed based largely on review of surveys of south shore visitors.

The Lake Tahoe Visitor Survey (ERA 1976, IV-17) discovered that 85% of all visitors to the south shore gamble, south shore visitors rank gaming as their most important recreational activity, and that persons staying in hotels and motels rank gaming as the most preferred recreational activity second only to rest and relaxation (ERA 1976, IV, Table 27). It appears then that about 15% of all adult visitors staying overnight in hotel and motel accommodations are primarily interested in non-gaming activities. Thus, growth in the demand for hotel and motel rooms is likely to occur as a consequence of casino expansion, and some growth in hotel and motel rooms is likely to occur even in the absence of casino expansion due to the growth of visitors whose primary interests are in non-gaming recreation.

Hotel/Motel Rooms

Estimates of hotel and motel rooms were made as follows:

- The number of rooms in 1978 and the growth of rooms over recent years were developed based on interviews and published sources (Recht Hausrath & Associates telephone survey, August 1978; Interview, South Lake Tahoe Visitor's Bureau; Conversations, CTRPA; ERA 1976, Table 61 IV pg. 89; TRPA 1977a, Table 1; TRPA, Estimates for AQMP work). It should be noted that the figure used for the number of hotel/motel rooms in California was obtained from CTRPA and concurred with that of the South Lake Tahoe Visitor's Bureau. Since the calculation of the growth scenarios, however, CTRPA has revised its estimate from 7,449 hotel/motel rooms to 6,986.
- The increase in hotel/motel rooms associated with an increase in gaming floor space was estimated using the present ratio of approximately 53 rooms for each 1,000 square feet of gaming floor space.
- Growth of hotel/motel rooms independent of gaming was assumed to occur at .45% per year based on the growth rate of this "autonomous" component over past years (average annual growth rate for rooms of 3% occurred in the south shore between 1974 and 1978, an increase

from roughly 8,600 to 9,700 rooms; 15% of this growth represents .45% per year).

Estimated south shore hotel/motel rooms for 1978 and for future years corresponding to assumptions made for casino expansion are the following:

1978 Estimate = Approximately 9,600 Rooms

	ESTIMATED HOTEL/MOTEL ROOMS		
	1990	2000	Increase 1978 to 2000
Low Casino Expansion	12,310	12,780	32%
Medium Casino Expansion	14,960	15,430	60%
High Casino Expansion	14,960	18,610	93%

Hotel/Motel Employment

Hotel/motel employment is estimated as a function of number of rooms, occupancy rates, and ratios of employees per occupied room.

- Relationships developed are the following:

Summer Season Employment = Number of Rooms x 90% Occupancy x .24 Employees Per Occupied Room

Winter Season Employment = Number of Rooms x 44% Occupancy x .30 Employees Per Occupied Room

- Ratios of employees per occupied room and occupancy rates are based on recent data (TRPA/USFS 1978, Appendix P; and ERA, 1976, Table 61).

- Increases in occupancy rates for the low season are likely to occur over time.

Hotel/motel employment estimates are summarized for the summer season in Appendix Table A-1.

AGRICULTURE AND MANUFACTURING

Employment in agriculture and manufacturing is small and is assumed to remain constant in future years (see Appendix Table A-1).

SERVICES

Service activities include those to accommodate the needs of local businesses, residents, and visitors. Service employment includes retail trade, wholesale trade, finance, business services, recreation, medical/legal services, education services, miscellaneous services, government, transportation/utilities, and other.

Service employment was estimated through an iterative process involving two major steps. First, ratios were developed so that service employment could be estimated as a multiple of employment in gaming, hotels/motels, manufacturing, and agriculture (employment categories described above). (Sources for these ratios include employment figures from the State of California Employment Development Division; the State of Nevada Employment Security Division, and 1974 TRTS data.) Second, service employment (estimated with ratios above) was adjusted after population estimates were completed to reflect the location of population growth (in STPUD, DCSID, or spillover to Carson Valley) and the mix of population groups with different spending patterns. Such adjustments were made by computing per capita ratios of service employment for different population groups based on the mix of population groups for 1978, spending patterns from visitor surveys (ERA 1976), and 1978 service employment estimates. The estimated ratios of service jobs per capita are the following: residents = .1045, second home visitors = .078, hotel/motel visitors = .1055, campers = .051, visitors staying with friends and relatives = .042, and day visitors = .022.

Total estimated service jobs are presented in Appendix Table A-1 combined vith construction employment estimates. Of the totals shown, service mployment accounts for all but about 300 - 1,400 jobs (1,200 for 1978) lepending on the scenario. Service jobs would account for all of the rowth of employment for this combined category.

ecause of the adjustments described above (second step), the relationhips between employment categories in Appendix Table A-1 are not consistnt across scenarios. This variation largely reflects differences in the elative importance of second home visitors (an economic base not reflected n the non-service employment categories) and in the size of the spillover opulation (as seen by comparing employment for scenarios 4 and 5).

While gaming employment is often added in relatively large increments (as new casinos are built), the expansion of service employment occurs more slowly as visitation and employment increase. Evaluation of the 1978 situation in light of longer term relationships indicated that significant expansion of the service sector is likely to occur in the near future as a result of economic forces already set in motion, related largely to the recent expansion of gaming (Park Tahoe). For purposes of estimation, it was assumed that while the growth of gaming employment had increased at about three-fourths of the increase in employment possible given the increase in gaming floor space, only about one-fourth of the corresponding growth of service employment had occurred in 1978. This "lag" in the growth of service employment is the reason for the significant growth in service jobs shown for all scenarios.

CONSTRUCTION

Two characteristics of the construction industry make it difficult to forecast such employment for specified years (1990, 2000) and difficult to relate jobs to housing demand and population. First, the construction industry is a particularly volatile industry; wide swings in employment are common from year to year. Selecting an average employment level to be used for 1990 and 2000 in the various scenarios misrepresents the character of construction employment. While housing construction may proceed relatively evenly through the time period, that is unlikely for casino, commercial, and hotel/motel construction. Further, by the end of the planning period when buildout is reached, construction employment is likely to be limited to that needed for remodeling and repairs; at levels below the employment for earlier years.

Second, the construction labor force is very mobile with workers often being employed at some distance from their place of residence. Therefore, shifting the location of construction sites does not necessarily imply that construction workers will move nearer the job site. It is highly probable that many construction workers employed in south shore live outside the Lake Tahoe Basin and also possible that some construction workers live in the basin and are employed outside.

For the purposes of the EIS, construction employment was considered relative to the growth of employment in other sectors and not analyzed in detail. Relative to total employment and the growth of housing demand and population, construction employees and their households do not represent large shares. Across scenarios, levels of construction employment do not vary greatly relative to variation in other sectors of the economy. However, construction employment is important insofar as construction is one of the industries which is quite sensitive to cessation or declining rates of growth (i.e., a major portion of the construction industry is clearly a growth-related sector).

For 1978, construction employment is estimated as 1,200 jobs (based primarily on ratios in TRPA/USFS, 1978). For the scenarios, it is likely that construction employment might vary from 300 (for modifications, repairs, additions, etc.) to about 1,400 (during heavy construction periods).

3. HOUSING AND RESIDENT POPULATION

Housing demand of three groups (employee households, retired/non-employed year-round households, and households seeking recreational, second homes) was considered in relation to potential increases in housing supply (as a function of housing development assumptions for each scenario) to estimate and describe housing development, resident population (year-round), and visitors in second homes. The methodology emphasizes the importance of the housing market in determining who will live in south shore and who will be able to purchase and rent second homes.

HOUSING DEVELOPMENT AND USE OF THE STOCK

Appendix Tables A-2 and A-3 summarize housing development and total housing units for STPUD and DCSID areas for 1978 and for each of the scenarios. Comparisons between STPUD and DCSID indicate the increasing share of south shore housing in the DCSID area.

Units approved in 1978 but not built and occupied by summer are included in the growth scenarios, not the existing 1978 totals. (As of October, 1978, units approved but not yet occupied were 280 in STPUD and 467 in DCSID.) The tables also describe the likely split between resident and non-resident use of the stock, indicating the increasing relative importance of second home usage.

The steps involved in "matching" households with increases in housing stock are described below.

Potential Increases in Housing Stock

The land available for residential development in STPUD and DCSID areas was identified and the number and types of units which could be built

TABLE A-2

TREES GROWTH SCENARIOS
SUMMARY OF HOUSING DEVELOPMENT AND USAGE FOR STPUD AREAS

	1978	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5
HOUSING DEVELOPMENT						
Number of Housing Units Built	N/A	2,072	10,000	6,036	2,072	10,000
Percent of South Shore Housing Development	N/A	55%	86%	55%	20%	55%
Additional Resident Housing for Employee and Retired Households	N/A	764	3,137	2,312	624	3,976
Additional Second Homes	N/A	1,308	6,863	3,724	1,448	6,024
HOUSING STOCK						
Total Housing Units	16,583	18,655	26,583	22,619	18,655	26,583
Percent of South Shore Housing	85%	80%	85%	74%	62%	70%
Percent Resident Housing	56%	54%	47%	51%	53%	50%
Percent Second Homes	44%	46%	53%	49%	47%	50%

TABLE A-3

TREES GROWTH SCENARIOS
SUMMARY OF HOUSING DEVELOPMENT
AND USAGE FOR DCSID AREAS

	1978	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5
HOUSING DEVELOPMENT						
Number of Housing Units Built	N/A	1,667	1,667	4,950	8,233	8,233
Percent of South Shore Housing Development	N/A	45%	14%	45%	80%	45%
Additional Resident Housing for Employee and Retired Households	N/A	623	833	2,827	3,967	3,651
Additional Second Homes	N/A	1,044	834	2,123	4,262	4,582
HOUSING STOCK						
Total Housing Units	2,985	4,652	4,652	7,935	11,218	11,218
Percent of South Shore Housing (STPUD & DCSID)	15%	20%	15%	26%	38%	30%
Percent Resident Housing	74%	61%	65%	63%	55%	52%
Percent Second Homes	26%	39%	35%	37%	45%	47%

under present land use policy was estimated. Table 7 in the text of the EIS describes the assumptions made about land use policy. Quantifications based on those assumptions are the following:

- For STPUD, there are about 10,000 vacant, subdivided, residential lots of which about 35% - 40% are in the city of South Lake Tahoe and the rest in the unincorporated areas of El Dorado County. (It should be noted that areas of El Dorado County outside of STPUD boundaries were not included in these totals.) For development of these lots, one single-family dwelling unit per lot was assumed (based on present CTRPA policies and likely market responses). Thus, buildout of subdivided lots under present policy would add about 10,000 housing units.

- For DCSID, the following residential land supply was developed:

Use District		No. Acres Subdivided	No. Acres Unsubdivided	No. of Housing Units Allowed
RE	(one unit per acre)	25.4	206.7	233
LDR	(4 units per acre)	196.9	323	2,080
MDR	(8 units per acre)	0.7	62.1	501
HDR	(15 units per acre)	2.2	359.2	5,419
				8,233

Of the total (8,233), 915 units could be built on presently subdivided land and 7,318 on land that is not yet subdivided. Regarding type of unit, densities on RE and LDR zoned land could provide for detached, single-family dwellings, while densities on MDR and HDR land would provide for condominiums and apartments.

The potential number of housing units above (8,233) assumes that all residentially zoned land is built at the highest allowable densities under present TRPA land use policies. Although the land use inventory described land capability classifications, the coverage limits under the various capability levels were not applied in developing buildout estimates (since they are not always observed or enforced). It is recognized that actual buildout could include fewer than the 8,233 units.

- Based on the assumptions described in the text of the EIS, the alternative levels of housing development assumed for defining growth scenarios include:

	STPUD	DCSID
Low	2,072 Units	1,667 Units
Medium	6,036 Units	4,950 Units
High	10,000 Units	8,233 Units

These levels were combined for the five growth scenarios as described in Appendix Tables A-2 and A-3.

The general prices (or rents) at which new units could be provided were estimated based on consideration of a number of factors.

Vacant, residential lots in STPUD (summarized by minor traffic zone) were categorized into four groups such that housing price ranges could be associated with new development, considering location and a number of other factors. In doing so, current market prices of homes in comparable, adjacent and nearby areas were evaluated as a key variable highly correlated with such important factors as lot size, view, amenities, "social character" of the neighborhood, etc.

Similar groupings were completed for residential lots and residentially zoned land in DCSID. Land capability levels were considered as affecting the cost of new construction (slope, erosion potential, etc. of high hazard land increases the cost of development).

The general costs of producing new housing were considered as were trends in the market prices of different types of units to develop the four relative price groups used to group the land supply to provide some indication of housing price for the units which could be built there:

Low:	Under $50,000
Medium:	$50,000 - $75,000
Upper Middle:	$75,000 - $125,000
High:	Over $125,000

These categories were also chosen to correspond to the employee household income categories (described below), assuming a relationship of three times income as providing an estimate of affordable housing.

Increases in Housing Demand: Employee Housing

Estimates of employment growth were converted into estimates of the growth of employee households by broad income categories. This information provides a measure of the demand for housing, including consideration of ability to pay for it. These estimates were made as follows:

- Income distributions were associated with the growth of employment in various job/industry categories. The employee income distributions used are those for summer employment from the 1974 TRTS survey (Dillingham, 1976) as translated into 1978 dollars:

Industry	Less than $10,000	$10,000 to $16,999	$17,000 to 26,000	$26,000 and Over
Gaming	50%	32%	12%	6%
Hotel/Motel	53%	21%	21%	5%
Agriculture/ Manufacturing	0	40%	60%	0
Service	17%	49%	25%	9%
Construction	0	0	65%	35%

Winter employment ratios are also available though not shown here because of the emphasis on summer and peak day populations for the purposes of this EIS.

Consideration was given to the additional income and purchasing power provided by tipping for some job categories (since it appears that tips are not included in the income information above) although quantified estimates were not made. Given the primary interest in income as related to ability to pay for housing, tipping increases ability to pay monthly rents though it may not substantially increase ability to purchase housing because of the problems of securing financing based on unreported and somewhat uncertain income.

- The increases in households associated with employment growth were estimated based on a ratio of employees per household. The ratio of 1.5 employees per household for summer season employment was used (based on TRTS information). This ratio would be lower for the winter since the number of employees per household increases during the summer season (because of housing market conditions, because of the temporary nature of these jobs, and/or because of the relatively larger number of younger, single adults in this group).

Ratios of employees per household can change over time as a function of changing socioeconomic and income characteristics of workers, of changing lifestyle preferences, and of changing housing market conditions. As this ratio changes, it affects the numbers of locally employed households (given numbers of employees) and it could affect the number of total persons (adults and children) per household, although it may not have such an effect. While it appears that employees per household (for employed households) is likely to increase for south shore (there appears to have been such an increase from 1970 to 1974), unemployed members of employee households (children, primarily) may show a decrease so it is not certain that total persons per household will increase (discussed in the population section of this methodology).

- The distribution of employee households among household income categories was based on the number of employees per household and the employee income distribution above. Given the average of 1.5 employees per household, one-half or one of every two households is shifted to the next highest income category, assuming that one-half of these households has two employees while the remaining one-half has one employed member.

Increases in Housing Demand: Retirement Housing and Second Homes

This demand is strong and is influenced by the growth and attractiveness of the area. The extent to which demand is met largely depends on the supply of available housing. Thus, definitive estimates of demand were not made as inputs into the housing analysis. Instead, the process (described below) of "matching" housing demand and supply is sensitive to the factors influencing demand and to the reasonableness of implied rates of growth.

Matching Housing Demand and Supply

The procedure used to "match" households with housing involved a series of judgments as to how the market is likely to operate when faced with various demand and supply factors.

he increase in employee households with various abilities to pay for housing was compared with the number of units which could be added in various price categories. Employee households were assumed to be housed as long as housing was likely to be available at affordable prices (affordability being judged in relation to household incomes). The potential for "spillover" of employee households to seek housing outside south shore was estimated by the extent to which employee households exceeded housing in the various household income/housing price categories.

The increase in second home and retired households was estimated by considering the difference between the total units to be added (under each scenario) and the number of those units likely to house employee households (or for which effective demand by employee households exists). The remaining ability to add housing (usually in higher priced categories) was considered to house second home owners and retired households as long as it seemed to represent a reasonable number of additional households for the time period under consideration.

In general, the rules of thumb/judgments used were that: (1) housing added in the lower price categories is likely to add to the stock used by employee households because of the small supply available in relation to the large demand for it; (2) housing added in the middle and upper middle price categories is likely to go to a mix of employee and second home/retired households; (3) the highest priced housing is likely to largely go to upper income second home households, wealthy retired households, or to other upper income households not employed in the basin. As such judgments were made, the implied mix of new households was compared to estimates of the mix for the existing stock and for additions in the recent past.

The resultant usage patterns for the stock are summarized in Appendix Tables A-2 (STPUD) and A-3 (DCSID). As presented, resident housing includes that used by employee households and retired households. In general, retired households are likely to occupy from 5% - 8% of the growth of housing and they are estimated to represent use of about 5% of the 1978 stock. Thus, most of the housing to be used by residents is likely to be occupied by employee households. It should be noted that the 1978 figures shown in the tables result from a number of existing sources (TRPA/TRTS, 1974; CTRPA, 1976a; Dillinghorn, 1976, etc.)

It should be noted that in actuality there will be a whole series of changes in who is housed where; whereby existing households in the area will get newer units or leave the area and additional employee households are likely to rent or buy units in the present stock rather than the new ones. However, for the purposes of defining scenarios, simplifying assumptions were made in dealing primarily with the increases in households and in housing units, recognizing the number of shifts and changes that are likely to take place in the total housing market (these interactions are discussed qualitatively in the setting and impact section of the EIS).

Attention was also given to the effect on housing prices of the relationship between housing supply (units added) and housing demand (including competition between different groups of housing demanders). In general it was assumed that housing prices would be bid up highest when supply is expanded least relative to demand. Such effects were considered in the process of making judgments on how housing stock and households are likely to match up.

Rates of Development

Rates of housing development were considered in the process of "matching" housing demand and supply. In general a low rate, of about 200 units per year, was assumed for the low levels of residential development (2,072 units in STPUD and 1,667 units in DCSID). For the medium and high levels of housing development, annual rates varied from 200 (until 1982 for STPUD) to 500, 600, and even 800 (during mid-years when land would be available) and back to about 200 as land supply became more scarce. These estimated rates provided an indication of the time period when the assumed additional housing units are likely to be built. A summary is provided below (note the differences between STPUD and DCSID within a scenario):

	STPUD		DCSID	
	Estimated Rates of Development	Estimated Buildout	Estimated Rates of Development	Estimated Buildout
	Average No. Units/Year		Average No. Units/Year	
SCENARIO 1	200	By 1990	200	By 1990
SCENARIO 2	200 - 800	By 2000	200	By 1990
SCENARIO 3	200 - 500	By 2000	200 - 400	By 2000
SCENARIO 4	200	By 1990	200 - 500	By 2000
SCENARIO 5	200 - 600	By 2000	200 - 500	By 2000

RESIDENT POPULATION

Population Totals

Appendix Tables A-4 through A-9 present detailed population estimates for 1978 and for 1990 and 2000 for each growth scenario. They describe peak day and average summer day population. Peak day estimates are considered to apply for both the peak summer and peak winter situations (per Montgomery Engineers). Estimates of the growth for any scenario can be derived by subtracting the 1978 estimates from the scenario totals shown.

Resident population is described across the first line of each table. The rest of the figures describe population for overnight and day visitor categories. The process of estimating resident population is described below, while the next section of this appendix discusses the visitor population estimates.

Resident Population

Resident household estimates were converted into population estimates based on housing occupancy rates and persons per household ratios as follows:

- Housing occupancy for average summer and peak day was assumed to be 100% for resident households (employee, retired, and other non-employed year-round residents).
- Persons per household for 1978 was 3.0 for STPUD (per CTRPA and TRTS) and 3.2 for DCSID (per TRPA and TRTS). For the growth scenarios, persons per household for the new units was assumed to be 3.2 for both STPUD and DCSID.
- Population estimates were made based on the following calculation assuming the ratios identified above:

$$\text{Resident Population} = \text{No. Housing Units in Resident Stock} \times \text{Housing Occupancy Rate} \times \text{Persons Per Household}$$

Persons per household ratios were estimated based on review of recent trends and consideration of the demographic, lifestyle, and housing market factors responsible for them. For resident households, there are both factors encouraging larger household sizes and those having the effect of lowering them. The two major factors considered in deciding to increase

TABLE A-4

TREES GROWTH SCENARIOS

POPULATION SUMMARY
1978

	PEAK POPULATION			AVERAGE SUMMER POPULATION		
	STPUD	DCSID	SOUTH SHORE	STPUD	DCSID	SOUTH SHORE
Residents	27,780	7,070	34,850	27,780	7,070	34,850
Second Home Visitors & Owners	21,090	2,720	23,810	16,680	2,150	18,830
Hotel/Motel Visitors	23,100	4,640	27,740	18,010	4,180	22,190
Those Visiting Friends and Relatives	14,820	3,530	18,350	1,670	400	2,070
Campers	4,290	1,400	5,690	3,860	1,260	5,120
TOTAL:						
Residents	27,780	7,070	34,850	27,780	7,070	34,850
Overnight Visitors	63,300	12,290	75,590	40,220	7,990	48,210
Day Visitors	--	--	55,180	--	--	35,190
TOTAL	--	--	165,620	--	--	118,250

TABLE A-5

TREES GROWTH SCENARIOS

POPULATION SUMMARY
SCENARIO 1

	PEAK POPULATION						AVERAGE SUMMER POPULATION					
	STPUD		DCSID		SOUTH SHORE		STPUD		DCSID		SOUTH SHORE	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Residents	30,220	30,220	9,060	9,060	39,280	39,280	30,220	30,220	9,060	9,060	39,280	39,280
Second Home Visitors & Owners	25,330	25,330	6,100	6,100	31,430	31,430	20,070	20,070	4,860	4,860	24,930	24,930
Hotel/Motel Visitors	26,100	26,100	7,640	7,640	33,740	33,740	20,710	20,710	6,880	6,880	27,590	27,590
Those Visiting Friends and Relatives	16,040	16,040	4,530	4,530	20,570	20,570	1,810	1,810	510	510	2,320	2,320
Campers	5,760	6,200	2,130	2,340	7,890	8,540	5,260	5,680	1,950	2,150	7,210	7,830
TOTAL:												
Residents	30,220	30,220	9,060	9,060	39,280	39,280	30,220	30,220	9,060	9,060	39,280	39,280
Overnight Visitors	73,230	73,670	20,400	20,610	93,630	94,280	47,850	48,270	14,200	14,400	62,050	62,070
Day Visitors	---	---	---	---	68,350	72,950	---	---	---	---	45,290	48,790
TOTAL	---	---	---	---	201,260	206,510	---	---	---	---	146,620	150,740

TABLE A-6

TREES GROWTH SCENARIOS

POPULATION SUMMARY
SCENARIO 2

	PEAK POPULATION						AVERAGE SUMMER POPULATION					
	STPUD		DCSID		SOUTH SHORE		STPUD		DCSID		SOUTH SHORE	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Residents	34,650	37,820	9,740	9,740	44,390	47,560	34,650	37,820	9,740	9,740	44,390	47,560
Second Home Visitors & Owners	37,460	43,320	5,420	5,420	42,880	48,740	29,780	34,470	4,310	4,310	34,090	38,780
Hotel/Motel Visitors	31,050	32,450	7,640	7,640	38,690	40,090	25,170	26,430	6,880	6,880	32,050	33,310
Those Visiting Friends and Relatives	18,260	19,840	4,860	4,860	23,120	24,700	2,060	2,240	550	550	2,610	2,790
Campers	5,760	6,900	2,130	2,690	7,890	9,590	5,260	6,350	1,950	2,480	7,210	8,830
TOTAL:												
Residents	34,650	37,820	9,740	9,740	44,390	47,560	34,650	37,820	9,740	9,740	44,390	47,560
Overnight Visitors	92,530	102,510	20,050	20,610	112,580	123,120	62,270	69,490	13,690	14,220	75,960	83,710
Day Visitors	---	---	---	---	82,180	89,870	---	---	---	---	55,450	61,110
TOTAL	---	---	---	---	239,150	260,550	---	---	---	---	175,800	192,380

TABLE A-7

TREES GROWTH SCENARIOS

POPULATION SUMMARY
SCENARIO 3

	PEAK POPULATION						AVERAGE SUMMER POPULATION					
	STPUD		DCSID		SOUTH SHORE		STPUD		DCSID		SOUTH SHORE	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Residents	34,230	35,170	14,860	16,110	49,090	51,280	34,230	35,170	14,860	16,110	49,090	51,280
Second Home Visitors & Owners	28,490	33,160	7,470	9,600	35,960	42,760	22,600	26,340	5,950	7,660	28,550	34,000
Hotel/Motel Visitors	31,050	31,750	12,590	13,290	43,640	45,040	25,170	25,800	11,340	11,970	36,510	37,770
Those Visiting Friends and Relatives	18,050	18,520	7,430	8,060	25,480	26,590	2,030	2,080	840	910	2,870	2,990
Campers	5,760	6,900	2,130	2,690	7,890	9,590	5,260	6,350	1,950	2,480	7,210	8,830
TOTAL:												
Residents	34,230	35,170	14,860	16,110	49,090	51,280	34,230	35,170	14,860	16,110	49,090	51,280
Overnight Visitors	83,350	90,330	29,620	33,640	112,970	123,970	55,060	60,570	20,080	23,020	75,140	83,590
Day Visitors	---	---	---	---	82,470	90,500	---	---	---	---	54,850	61,020
TOTAL	---	---	---	---	244,530	265,750	---	---	---	---	179,080	195,890

TABLE A-8

TREES GROWTH SCENARIOS

POPULATION SUMMARY
SCENARIO 4

	PEAK POPULATION						AVERAGE SUMMER POPULATION					
	STPUD		DCSID		SOUTH SHORE		STPUD		DCSID		SOUTH SHORE	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Residents	29,780	29,780	16,510	19,760	46,290	49,540	29,780	29,780	16,510	19,760	46,290	49,540
Second Home Visitors & Owners	25,780	25,780	12,600	16,540	38,380	42,320	20,430	20,430	10,060	13,210	30,490	33,640
Hotel/Motel Visitors	26,100	26,100	17,540	28,480	43,640	54,580	20,710	20,710	15,790	25,640	36,500	46,350
Those Visiting Friends and Relatives	15,820	15,820	8,250	9,880	24,070	25,700	1,780	1,780	931	1,111	2,710	2,890
Campers	5,760	6,900	2,130	2,690	7,890	9,590	5,260	6,350	1,950	2,480	7,210	8,830
TOTAL:												
Residents	29,780	29,780	16,510	19,760	46,290	49,540	29,780	29,780	16,510	19,760	46,290	49,540
Overnight Visitors	73,460	74,600	40,520	57,590	113,980	132,190	48,180	49,270	28,731	42,441	76,910	91,710
Day Visitors	---	---	---	---	83,200	96,490	---	---	---	---	56,140	66,940
TOTAL	---	---	---	---	243,470	278,220	---	---	---	---	179,340	208,190

TABLE A-9

TREES GROWTH SCENARIOS

POPULATION SUMMARY
SCENARIO 5

	PEAK POPULATION						AVERAGE SUMMER POPULATION					
	STPUD		DCSID		SOUTH SHORE		STPUD		DCSID		SOUTH SHORE	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Residents	35,530	40,510	15,140	18,760	50,670	59,270	35,530	40,510	15,140	18,760	50,670	59,270
Second Home Visitors & Owners	31,390	40,610	11,400	17,570	42,790	58,180	24,920	32,290	9,090	14,020	34,010	46,310
Hotel/Motel Visitors	31,050	34,500	12,590	20,080	43,640	54,580	25,170	28,270	11,340	18,080	36,510	46,350
Those Visiting Friends and Relatives	18,690	21,180	7,560	9,370	26,250	30,550	2,110	2,390	850	1,050	2,960	3,440
Campers	5,760	6,900	2,130	2,690	7,890	9,590	5,260	6,350	1,950	2,480	7,210	8,830
TOTAL:												
Residents	35,530	40,510	15,140	18,760	50,670	59,270	35,530	40,510	15,140	18,760	50,670	59,270
Overnight Visitors	86,890	103,190	33,680	49,710	120,570	152,900	57,460	69,300	23,230	35,630	80,690	104,930
Day Visitors	---	---	---	---	88,020	111,620	---	---	---	---	58,900	76,600
TOTAL	---	---	---	---	259,260	323,790	---	---	---	---	190,260	240,800

household sizes in STPUD and assume constant ones in DCSID are the following:

- Housing market conditions are encouraging larger household sizes to the extent that individuals and non-family households are encouraged to double up as housing prices rise. At the same time, the scarcity of affordable housing is leading to "spillover" of employee households to areas outside the south shore and the larger, family households are prevalent in this group. While it appears that employees per household will continue to increase, unemployed members of employee households (children, primarily) may decline so as to leave total persons per household unaffected or showing only a small increase. (Both of these trends appear to have occurred and balanced each other over the 1970 to 1974 period.)

- Since future housing development in STPUD will be single-family homes (which have had more persons per unit than multiple units), household size for the new housing is likely to be larger than the average for the existing resident stock. For DCSID, some mix of types of units is likely to continue, having no significant impact on persons per unit.

It should be noted that the person per household ratios discussed here are only for the resident housing stock. As such, they cannot be compared with overall, average persons per household for all housing because of the share used as second homes (see visitor population estimates for those in second homes in the next section). Second homes have had more persons per unit on peak and summer days than resident housing and somewhat lower unit occupancies. The net effect of combining resident and second home population is to increase average persons per household over the averages for only the resident stock. Thus, as the mix of housing usage changes over time with second homes representing a larger share of the total, overall ratios of persons per housing unit increase.

Similarly, occupancy and persons per unit ratios for all other visitor population groups were considered separately so that overall average ratios will reflect both the changes in the factors affecting any one group as well as the changes in the overall mix of facilities, occupancy and usage patterns.

4. VISITOR POPULATION

Estimates of visitors on the peak and average summer days are presented in Appendix Tables A-4 through A-9. Estimates of annual visitor days for

1978 and for the growth scenarios are shown in Appendix Tables A-10 through A-12.

The estimation of visitor levels is a difficult task. Some visitors are attracted by one particular recreational activity, such as gaming, while others are attracted by several recreational activities. While some information (primarily data collected by the U. S. Forest Service) detailing the levels of use of certain recreational facilities is available, this data does not distinguish between residents who use these facilities and visitors, nor does it provide the basis for estimating the number of visitors (the Forest Service records only the time spent by visitors in the facilities and not the number of people who come). The lack of data and the fact that visitors likely undertake several activities makes it impossible to estimate visitor levels strictly on the basis of available recreational facilities.

The method adopted for the purpose of defining growth scenarios estimates and forecasts visitors classified by type of accommodation. The visitor categories obtained thereby are hotel/motel visitors, second home visitors (both owner-occupied and rental), visitors staying in campgrounds, friends and relatives staying with residents, and day visitors (which includes people staying elsewhere in the basin but who visit the south shore).

Several assumptions implicit in this method should be mentioned. First, it has been assumed that additional accommodations will be utilized as they have been in the past, or utilized even more intensively (higher occupancy rates and increases in persons per household). This implies that the features and recreational facilities in south shore can sustain or will expand to the level required to maintain the relation between accommodations, visitor attractions, and visitor levels. To the extent that hotel and motel accommodations and campground sites have been estimated based on the expansion of gaming and Forest Service recreation development plans (which are the major attractions for visitors who use these accommodations), this assumption is quite reasonable. The fact that second home visitors site gaming as a most important activity (Lake Tahoe Visitor's Survey 1975) further rationalizes this assumption.

Second, estimation of visitors from accommodations precludes any dampening effect on visitor levels of crowding, congestion, and environmental deterioration as population levels rise. The effects of such externalities are conjectural at this point and will be strongly influenced by the mitigation measures developed to meet environmental standards. Hence these effects are more properly addressed in the impact section of the report.

Third, development of private recreational and service (marinas, movies, restaurants, etc.) facilities adequate to meet the needs of increased visitors is assumed to occur.

TABLE A-10

TREES GROWTH SCENARIOS

SUMMARY OF ANNUAL VISITOR DAYS (000)
1978 AND SCENARIO 1

	1978			SCENARIO 1					
	STPUD	DCSID	SOUTH SHORE	STPUD		DCSID		SOUTH SHORE	
				1990	2000	1990	2000	1990	2000
Second Home Visitors & Owners	3,421	442	3,863	4,108	4,108	991	991	5,099	5,099
Hotel/Motel Visitors	5,901	1,186	7,087	6,667	6,667	1,952	1,952	8,620	8,620
Those Visiting Friends and Relatives	426	102	528	461	461	130	130	591	591
Campers	347	113	461	473	511	175	194	649	705
T O T A L:									
Overnight Visits	10,095	1,843	11,938	11,710	11,747	3,249	3,267	14,958	15,014
Day Visits	---	---	8,714	---	---	---	---	10,920	11,692
TOTAL	---	---	20,652	---	---	---	---	25,878	26,706

(Totals may not add exactly due to rounding.)

TABLE A-11

TREES GROWTH SCENARIOS

SUMMARY OF ANNUAL VISITOR DAYS (000)
SCENARIOS 2 and 3

	SCENARIO 2						SCENARIO 3					
	STPUD		DCSID		SOUTH SHORE		STPUD		DCSID		SOUTH SHORE	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Second Home Visitors and Owners	6,077	7,028	880	880	6,957	7,908	4,621	5,379	1,212	1,558	5,833	6,936
Hotel/Motel Visitors	7,932	8,291	1,952	1,952	9,884	10,243	7,932	8,111	3,217	3,396	11,149	11,508
Those Visiting Friends and Relatives	525	570	140	140	665	710	519	532	214	232	732	764
Campers	473	571	175	224	649	794	473	571	175	224	649	794
T O T A L:												
Overnight Visits	15,007	16,460	3,148	3,196	18,155	19,656	13,545	14,593	4,818	5,409	18,363	20,002
Day Visits	---	---	---	---	13,253	14,349	---	---	---	---	13,405	14,601
TOTAL	---	---	---	---	31,407	34,005	---	---	---	---	31,767	34,603

(Totals may not add exactly due to rounding.)

TABLE A-12

TREES GROWTH SCENARIOS

SUMMARY OF ANNUAL VISITOR DAYS (000)
SCENARIOS 4 and 5

	SCENARIO 4						SCENARIO 5					
	STPUD		DCSID		SOUTH SHORE		STPUD		DCSID		SOUTH SHORE	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Second Home Visitors and Owners	4,182	4,182	2,045	2,684	6,227	6,866	5,092	6,587	1,850	2,850	6,942	9,437
Hotel/Motel Visitors	6,667	6,667	4,482	7,278	11,149	13,945	7,932	8,813	3,217	5,132	11,149	13,945
Those Visiting Friends and Relatives	455	455	237	284	692	739	537	609	218	270	755	878
Campers	473	571	175	224	649	794	473	571	175	224	649	794
T O T A L:												
Overnight Visits	11,777	11,875	6,939	10,470	18,716	22,344	14,034	16,580	5,460	8,475	19,494	25,055
Day Visits	---	---	---	---	13,663	16,311	---	---	---	---	14,231	18,290
TOTAL	---	---	---	---	32,380	38,656	---	---	---	---	33,725	43,346

(Totals may not add exactly due to rounding.)

The specifics of the calculations used to develop estimates are described below:

HOTEL/MOTEL VISITORS

Overnight visitors staying in hotels/motels were estimated for the scenarios as follows:

Peak Day Visitors = Number of Rooms x 100% Occupancy x 3 Persons Per Room

Visitors For Average Summer Day = Number of Rooms x 90% Occupancy x 3 Persons Per Room

Annual Visitor Days = Number of Rooms x 70% Average Annual Occupancy x 365 Days Per Year x 3 persons Per Room

For the 1978 estimates, visitors for an average summer day were estimated assuming the following:

	Persons Per Room	Average Summer Occupancy
STPUD	3.1	78%
DCSID	2.1	90%

(Occupancy rates are based on rates reported by Bob Anderson of the South Lake Tahoe Visitor's Bureau; average annual rates used in TRPA/USFS 1978, Appendix F; and CTRPA "Population Figures Summary Statement". Estimates of persons per room are based on figures from Lake Tahoe Visitor Surveys, ERA 1976; CTRPA "Population Figures - Summary Statement"; TRPA/USFS, 1978, Appendix F; and TRPA 1973, A-9.)

Estimates of number of rooms are described earlier in the hotel/motel employment section of this appendix.

CAMPERS

Overnight visitors staying in campgrounds were estimated for the scenarios as follows:

Peak Day Campers = Number of Campsites x 100% Maximum Occupancy x 3.5 Persons Per Campsite

Campers for Average Summer Day = Number of Campsites x 95% Summer Occupancy x 3.5 Persons Per Campsite

Annual Visitor Days = Number of Campsites x 90% Average Occupancy x 90 Day Season x 3.5 Persons Per Campsite

For the 1978 baseline, campers on an average summer day were estimated assuming 90% summer occupancy. (Occupancy rates and persons per site are based on CTRPA "Population Figures Summary Statement", and ERA 1976, Table 61.)

Estimates of future campsites were based on additional sites to be built by the U. S. Forest Service under its "Fair Share" Plan and on estimates of the addition of other sites, primarily those to be privately operated (including RV facilities). Numbers of future campsites are shown in Appendix Table A-13.

The U. S. Forest Service "Fair Share" Plan currently plans for the development of an additional 3,000 PAOT (persons at one time) in diverse facilities by 1990 and a further expansion of 2,000 PAOT between 1990 and 2000. Of these additional PAOT's, 53% will be at the south shore and 62% of them will be provided by constructing campsites (per Jon Hoeffer, U. S. Forest Service, 9/6/78). Thus, at 100% occupancy, 986 additional people will be accommodated by Forest Service campsites by 1990 and 657 more by 2000. At 3.5 persons per campsite, the Forest Service would build 328

TABLE A-13

TREES GROWTH SCENARIOS
SUMMARY OF CAMPSITES

	TOTAL CAMPSITES			DEVELOPMENT OF CAMPSITES		
	TOTAL	STPUD	DCSID		FOREST SERVICE	OTHER
1978	1,625	1,225	400			
Growth SCENARIO 1						
1990	2,253	1,646	607	Growth 1978 to 1990	328	300
2000	2,440	1,772	668	Growth 1990 to 2000	187	0
Growth SCENARIOS 2 - 5						
1990	2,253	1,646	607	Growth 1978 to 1990	328	300
2000	2,740	1,973	767	Growth 1990 to 2000	187	300
				Planned Growth After 2000	485	N/A

sites by 1990 and another 187 by 2000. Private campsite development is assumed to add 300 sites by 1990 and a further increment of 300 by 2000 for all scenarios except Scenario 1.

Since contracted reserve sewer treatment capacity for the U. S. Forest Service is not likely to be fully used by the year 2000, some development and visitor population in addition to that defined by the scenarios will occur as a result of buildout under current plans for National Forest Service land. Forest Service buildout would assume an increase over 1978 of 1,000 campsites while the scenarios include the increase of 515 campsites by year 2000.

VISITORS IN SECOND HOMES

Overnight visitors in second homes (including owners and those renting the units) were estimated for the scenarios assuming:

Peak Day Visitors = Number of Homes x 90% Occupancy x 3.6 Persons Per Unit

Visitors for Average Summer Day = Number of Homes x 72% Occupancy x 3.6 Persons Per Unit

Annual Visitor Days = Number of Homes x 40% Average Annual Occupancy x 365 Days Per Year x 3.6 Persons Per Unit

For the 1978 baseline only, visitors for an average summer day were estimated assuming 71.2% occupancy and the following persons per unit: 3.2 for STPUD and 3.9 for DCSID.

(Sources for occupancy and persons per unit assumptions are: TRTS survey from TRPA/USFS,1978, p. 22 and other Dornbusch work; ERA 1976, IV p. 55 and Table 88; CTRPA; and TRPA.)

Estimates of second home additions are discussed earlier in the housing section of this appendix and shown in Appendix Tables A-2 and A-3.

VISITORS STAYING WITH FRIENDS AND RELATIVES

Overnight visitors staying with friends and relatives were estimated by developing a ratio of the number of visitor days with friends and relatives in the south shore (420,000 as estimated from ERA, 1976, Tables 88 and 89) to the number of permanent households. That ratio of 46 visitor days per year per permanent household is used to estimate annual visitor days of friends and relatives:

$$\text{Annual Visitor Days} = \text{Number of Resident Households} \times \text{46 Visitor Days Per Household Per Year}$$

To derive an average summer ratio, the seasonality index developed by ERA (cited in TRPA 1977a, Figure 1) was used:

$$\text{Visitors for Average Summer Day} = \text{Number of Resident Households} \times \text{.18 Visitors Per Household}$$

The peak summer ratio assumes the seasonality index for August and concentrates the visitors on the weekends:

$$\text{Peak Day Visitors} = \text{Number of Resident Households} \times \text{1.6 Visitors Per Household}$$

Increases in resident households are described earlier in the resident population and housing section of this appendix and in Appendix Tables A-2 and A-3.

DAY VISITORS

Day visitors were estimated for the 1978 baseline and the growth scenarios as follows:

Day Visitors on Peak Day = Peak Day Overnight Visitors × .73 Day Visitors Per One Night Visitor

Day Visitors on Average Summer Day = Overnight Visitors on Average Summer Day × .73 Day Visitors Per One Night Visitor

Annual Day Visitors = Annual Overnight Visitor Days × .73 Day Visitors Per One Night Visitor

From the 1974 TRTS population figures for the total Lake Tahoe Basin, the ratio of .73 day visitors to each overnight visitor (staying in second homes, hotels/motels, campgrounds, and with friends and relatives) was obtained as follows:

$$\frac{39{,}795 \text{ Day Visitors}}{54{,}036 \text{ Overnight Visitors}} = .73$$

The use of this ratio to estimate day visitors as a function of overnight visitors implies that day visitors increase proportionately to the overall growth of south shore activity including visitor attractions (casinos, Forest Service facilities), accommodations, restaurants, etc.

Given the lack of data describing day visitors, this estimated ratio was cross-checked by combining information from a number of sources (TRTS; TRPA, 1977a and TRPA, 1978a).

Two sets of calculations were made for comparison purposes. The first (Method A, shown below) compares overnight visitor estimates with casino patronage estimates to identify day visitors. The second (Method B, shown below following Method A) uses the .73 ratio as the basis for day visitor estimates. Comparison between the two shows very similar results; a difference of approximately 3%. This difference is sufficiently small to provide support for the use of this ratio in this effort. In the absence of additional information, it is reasonable to assume this ratio can be used for future time periods (1990, 2000) as well. (It is recognized that these methods neglect the gaming activities of residents. However, it is suspected that this is at least partially offset by second home owners and visitors who may not gamble as much as other visitors.)

METHOD A

	11,147,586	Annual overnight visitor days for 1974 estimated using procedures described in earlier subsections
×	83%	Percent of visitors 21 years of age and older per TRTS
	9,252,496	Annual adult overnight visitor days for 1974
×	85%	Percent of adult visitors who gamble per Lake Tahoe Visitors Survey (ERA)
	7,864,622	Annual adult overnight visitors who gamble
	13,792,600	1974 annual casino patronage estimates
-	7,864,622	Casino patrons who are overnight visitors
	5,927,978	Casino patrons who are day visitors

METHOD B

	11,147,586	Annual overnight visitor days for 1974 estimated using procedures described in earlier subsections
×	73%	Ratio of TRTS day visitors to TRTS overnight visitors
	8,137,738	Estimated annual day visitors
×	83%	Percent of visitors 21 years of age and older per TRTS
	6,754,322	Annual adult day visitors for 1974
×	85%	Percent of adult visitors who gamble per Lake Tahoe Visitors Survey (ERA)
	5,741,174	Adult day visitors who gamble

5. COMMERCIAL DEVELOPMENT

Estimates of the growth of employment were converted into approximations (gross estimates) of land required for new development and of additional building floor space. These estimates were compared with land supply estimates (assuming present land use policy) to check that employment growth was not inconsistent with land availability. Both of these estimates were used as the basis for considering the likely distribution of commercial development between STPUD and DCSID areas.

COMMERCIAL LAND SUPPLY

Hotel and motel units can be built on land zoned tourist commercial (TC) as well as on general commercial (GC) land. CTRPA (STPUD areas) allows 20 units (transient dwelling units) per acre while TRPA (DCSID) permits 40 units per acre.

Based on the assumptions described below, estimates of the maximum potential hotel/motel development on vacant land zoned TC (land supply per Sedway/Cooke) are the following:

AREA	POTENTIAL, ADDITIONAL HOTEL/MOTEL ROOMS
City of South Lake Tahoe	3,928
Unincorporated El Dorado County	334
STPUD TOTAL	4,262
DCSID TOTAL	3,720

- For CTRPA areas, the estimates are based on TC zoned land in land capability classes 4 through 7 at an assumed density of 20 units per acre. Land with capabilities 1, 2, and 3 was not included in the estimates.
- For TRPA areas, hotel/motel estimates are based on TC zoned land in all capability classes at an assumed density of 40 units per acre.

As a basis of comparison for potential hotel/motel development in DCSID, TRPA assumed 3,192 new units for air quality planning, basing their estimate on vacant TC zoned land and casino development proposals. They have also indicated that there is additional potential for hotel/motel development on GC zoned land.

For STPUD, CTRPA estimates of hotel/motel development for air quality planning include 3,347 units although they have stated that about 1,700 units might be a more reasonable estimate if the characteristics of individual parcels are evaluated.

Commercial development to accommodate the types of activities included under the broad category of service employment can be built on land zoned general commercial (GC). Based on the assumptions stated below, estimates of potential commercial floor space development on vacant, GC land are the following:

AREA	POTENTIAL ADDITIONAL COMMERCIAL FLOOR SPACE
STPUD	1.62 million sq. ft. - 2.3 million sq. ft.
DCSID	2.8 million sq. ft.

- Additional floor space estimates were made as follows:

$$\text{Commercial Floor Space} = \text{Vacant GC Land by Land Capability Class} \times \text{Land Coverage Ratio} \times \text{Building to Parking Ratio} \times \text{Average Number Stories (Height)}$$

- For CTRPA areas, land with capability 1-3 (high to moderate hazard land) was not included in the development estimates. Land with capability 4 was assumed to have 20% land coverage, capability 5 to have 25% coverage, and capabilities 6 and 7 to have 30% coverage. Of the developable site, 40% was assumed to be building and 60% to be used for parking (per Sedway/Cooke). Although development is allowed at up to 3 stories in height, estimates were made assuming an average of 2 stories (1.62 million square feet) and an average of 2.5 stories (2.3 million square feet).

- For TRPA areas, it was assumed that land of all capabilities could be developed at 70% land coverage and that 40% of the buildable site would go to buildings and 60% to parking. Although development is allowed at up to 5 stories, the estimates assume an average of 3 stories for the new space.

Both the hotel/motel and commercial floor space estimates are based on overall land supply totals and do not reflect consideration of the characteristics of individual parcels (parcel size, accessability, location, etc.). It is recognized that both the location and physical features of land zoned for commercial development affect its desirability. Land located near the center of activity is likely to be developed sooner than land further removed, unless the surrounding land uses and the size and physical features of a parcel make it less desirable. As development pressures increase, however, the less desirable lots will begin to be developed. In addition, strong demands for rezoning will arise, presenting the prospect of a different array of commercial sites.

HOTEL/MOTEL DEVELOPMENT

The estimates of hotel/motel rooms (see employment section earlier in this appendix) are shown for STPUD and DCSID areas in Appendix Table A-14 (the 450 rooms in the Park Tahoe Casino are included in the growth estimates for DCSID and not the 1978 baseline). For all scenarios, DCSID is likely to capture a larger share of the growth of rooms in south shore than is currently represented by their share of existing rooms.

Comparisons of likely development with land supply, indicate that for Scenarios 4 and 5 (those with high casino growth), market pressures for hotel/motel development are likely to be significantly greater than can be met by development on currently vacant, TC zoned land (assuming current land use policies). As a result, there are likely to be:

- pressures for rezonings, variances in coverage requirements and height limits, etc.;
- probably some rehabing of older units, some redevelopment, etc.;
- hotel/motel development on GC zoned land as well as TC zoned land;
- pressures to intensify hotel use on casino sites (where existing casino hotels may not be developed at the maximum allowable under present zoning); and

TABLE A-14

TREES GROWTH SCENARIOS
SUMMARY OF HOTEL/MOTEL ROOMS

SCENARIO		TOTAL ROOMS			NEW DEVELOPMENT	
		1978	1990	2000	1978 to 1990	1990 to 2000
1	STPUD	7,450	8,450	8,450	1,000	0
	DCSID	2,210	3,210	3,210	1,000	0
2	STPUD	7,450	9,100	9,570	1,650	470
	DCSID	2,210	3,210	3,210	1,000	0
3	STPUD	7,450	10,100	10,330	2,650	230
	DCSID	2,210	4,860	5,090	2,650	230
4	STPUD	7,450	8,450	8,450	1,000	0
	DCSID	2,210	6,510	10,160	4,300	3,650
5	STPUD	7,450	10,100	11,250	2,650	1,150
	DCSID	2,210	4,860	7,360	2,650	2,500

- possibly some shifts whereby occupancies in second homes increase, camping increases, and day use increases.

Since a combination of the above is likely to occur, the actual hotel/motel rooms built under Scenarios 4 and 5 may be less than shown in Table A-14. That difference would represent a shift of visitors among types of accommodations or from overnight to day use and would not significantly affect the population totals for these scenarios nor the estimated wastewater treatment plant capacities for them.

COMMERCIAL/SERVICE DEVELOPMENT

The amount of commercial floor space to be added under any scenario is determined by the level of non-casino, non-hotel/motel service sector employment. The development of commercial floor space was estimated by converting the service employment growth figures (see employment section of this appendix) into floor space estimates using an average of 500 square feet (gross floor area) per employee. (This average is a composite of square feet per employee ratios of 200 - 250 square feet for office space, 400 - 450 square feet for personal and business services, and 600 square feet for retail establishments.)

Appendix Table A-15 summarizes the estimates of commercial development (square feet) for the scenarios. It identifies the increasingly important role of DCSID areas as the likely location for future commercial development. Comparison between the growth estimates and the land supply indicate that commercial land availability is not likely to provide a major constraint to commercial development under any of the scenarios. (The comparison also indicates that GC zoned land in DCSID could probably be used for some hotel/motel development without significantly affecting the supply for commercial development.

6. SPILLOVER

"Spillover" is determined by the number of casino and service sector employees who may be unable to find housing in south shore. As a result, pressures for residential development would be created in nearby areas.

The magnitude of spillover was estimated during the process of "matching" households with housing (see housing section of this appendix). Employed households were assumed to be housed as long as housing was likely to be

TABLE A-15

TREES GROWTH SCENARIOS

SUMMARY OF COMMERCIAL FLOOR SPACE

		SCENARIOS				
	1978	1	2	3	4	5
TOTALS (million sq. ft.)						
STPUD	3.7	4.4	5.7	5.1	4.1	5.8
DCSID	.7	1.3	1.1	1.9	3.3	2.7
TOTAL	4.4	5.7	6.8	7.0	7.4	8.5
NEW DEVELOPMENT (million sq. ft.)						
1978 to 1990						
STPUD		.67	1.25	.98	.44	1.29
DCSID		.57	.35	.94	1.46	1.24
1990 to 2000						
STPUD		0	.76	.43	0	.79
DCSID		0	0	.29	1.12	.79

available at affordable prices. The potential for spillover was estimated by the extent to which employee households exceeded housing in the various household income/housing price categories. In effect, spillover is a result or residual of the "match" between economic growth and housing development in south shore.

Appendix Table A-16 describes the spillover estimates for the scenarios. Very little information exists to describe the 1978 baseline situation. It is possible to estimate present spillover at up to 3,000 to 3,500 households (including south shore workers residing outside south shore in Carson City, Carson Valley, and other areas).

Spillover is described in terms of households, resident population (assuming an average of 3.2 persons per household), commuters to south shore, and service jobs (outside south shore) supported by the spillover population. It includes both the population that continues to commute to south shore jobs and the population which exists outside of south shore to serve these commuter households.

As shown, Scenarios 4 and 5 generate the largest spillover and Scenarios 1 and 2 generate the least. This indicates that casino development is quantitatively a more important determinant of spillover than the ability to develop housing in STPUD, although the latter is not without effect (as can be seen by comparing spillover for Scenarios 1 and 2 or 4 and 5). This finding is, of course, consistent with the definition of spillover as being generated by the growth of south shore employee households who are unable to find housing in the basin.

This spillover is most likely to go to the Carson Valley areas of Douglas County given its proximity, desirability, and large potential for housing development. It is much less likely that it would go to the north shore, Carson City, or Alpine County. The housing market in north shore is similar to that in south shore and the potential for development in Carson City is presently very limited while the demand remains strong there. Alpine County has several potentially developable areas but will likely be developed only as a consequence of extensive pressure to do so and will likely not be developed with housing that is affordable to most south shore employees. While it is most likely that the spillover will occur in the Carson Valley areas of Douglas County, it is assumed, for the purposes of impact assessment in some issue areas, that 5 percent of spillover could go to Alpine County.

While the scenarios have considered the factors influencing south shore growth, consideration of Carson Valley has been limited to development pressures resulting from south shore activity; i.e., that which is influenced by STPUD and DCSID capacity decisions. It is recognized that other factors

TABLE A-16

TREES GROWTH SCENARIOS

SUMMARY OF SPILLOVER POTENTIAL
(Increase from 1978 Baseline)

	SCENARIO				
	1	2	3	4	5
Residents					
1978 to 1990	4,270	2,030	5,330	8,550	7,400
1990 to 2000	0	1,420	1,870	12,820	11,580
TOTAL	4,270	3,450	7,200	21,370	18,980
Housing Units					
1978 to 1990	1,340	640	1,660	2,670	2,310
1990 to 2000	0	440	590	4,010	3,620
TOTAL	1,340	1,080	2,250	6,680	5,930
Service Employment					
1978 to 1990	380	180	470	760	660
1990 to 2000	0	130	170	1,140	1,030
TOTAL	380	310	640	1,900	1,690
Commuters to South Shore					
1978 to 1990	1,620	770	2,020	2,350	760
1990 to 2000	0	540	710	4,870	1,140
TOTAL	1,620	1,310	2,730	8,120	1,900

will also have a significant effect on growth there. Analysis to define growth scenarios for Carson Valley would have to consider: (1) the probable outcome of the many factors influencing spillover from Carson City and Reno; (2) the nature of other demands for locations in this valley; and (3) the public policy responses to growth pressures from all of these sources. This has not been done in other studies and would require the consideration of a number of economic factors and public policy decisions relevant to areas outside those influenced by the capacity decisions under evaluation in this EIS.

7. SMALL AREA ANALYSIS

Information developed in the process of defining growth scenarios for STPUD and DCSID provides insight for considering the general areas within each district where development is likely to occur. Although detailed analysis on a small area basis (considering ownership patterns, public service availability, site characteristics, parcel sizes, etc.) was not done, consideration was given to the general locations of vacant land, land capability ratings, perceived market preferences, and zoning to develop "best guesses" as to the general locations of future residential development. (Some discussion of the location preferences for commercial development is included in the earlier section of this appendix dealing with that topic.)

STPUD AREAS

Appendix Table A-17 presents "guesstimates" of the location of housing development by major traffic zones. Scenarios 2 and 5 assume buildout of all subdivided lots and provide the best site specific information. The estimates for Scenarios 1, 3, and 4 provide some indication of likely development patterns although it is possible that any of the subdivided lots could be developed, given present land use policies. (Policies would have to change to insure that certain lots were used for the lower growth scenarios or that certain lots were used before others.) Generally, lots which were closer in and accessible to activity centers and those in the higher priced areas were assumed to feel the most pressure for development. (While there may be some differences between Scenarios 1 and 4, it was not possible to quantify them here.)

Following STPUD and Lahontan estimates, it was assumed that sewer connection permits would be allocated one-half in the city of South Lake Tahoe and one-half in the unincorporated areas of El Dorado County. This assumption applied for development over the next several years (to 1982 at least), and for all of the development for Scenarios 1 and 4.

TABLE A-17

TREES GROWTH SCENARIOS

RESIDENTIAL DEVELOPMENT PATTERNS ESTIMATES FOR STPUD AREAS

(Housing Units)

MAJOR TRAFFIC ZONE	SCENARIOS 1 & 4	SCENARIO 3	SCENARIOS 2 & 5
1	0	23	23
2	345	748	774
3	75	100	278
4	125	151	233
5	100	425	681
6	341	1,087	1,115
7	50	157	503
CITY OF SOUTH LAKE TAHOE	1,036	2,691	3,607
10	400	699	1,104
11	200	971	2,120
12	0	50	83
13	174	408	827
14	262	1,117	2,107
15	0	0	46
16	0	0	5
UNINCORPORATED AREAS OF EL DORADO COUNTY	1,036	3,245	6,292 101*
TOTAL HOUSING UNITS DEVELOPED	2,072	6,036	10,000

*Location information not readily available.

For Scenario 3, a little more than half of the development is likely to occur in the city (about 55 percent). This implies that about three-fourths of the vacant lots in the city would be used while about half of those in the unincorporated parts of the county would be developed.

DCSID AREAS

Appendix Table A-18 describes the major traffic zones where DCSID development might take place. As for STPUD, the buildout scenarios (4 and 5) provide the best site specific information. For the other scenarios, it cannot be assumed that development would necessarily locate as described here (unless policy changes were made to encourage a specific pattern).

For Scenarios 1 and 2, all subdivided land is likely to be developed (potential for 951 units) as well as some non-subdivided land; primarily that located in areas nearest to existing residential neighborhoods. For Scenario 3, a greater amount of non-subdivided land is developed. For Scenarios 4 and 5, all presently zoned residential land is assumed to be used. As shown, each scenario is likely to include a mix of types of units (see guesstimates in Appendix Table A-18).

TABLE A-18

TREES GROWTH SCENARIOS

RESIDENTIAL DEVELOPMENT PATTERNS ESTIMATES FOR DCSID AREAS

(Housing Units)

MAJOR TRAFFIC ZONE	SCENARIOS 1 & 2	SCENARIO 3	SCENARIOS 4 & 5
30	0	233	785
31	389	1,211	1,533
32	564	2,399	4,708
33	685	1,022	1,093
34	0	60	60
35	29	25	55
TOTAL HOUSING UNITS DEVELOPED	1,667	4,950	8,234
HOUSING TYPE AS A FUNCTION OF DENSITIES			
RE: 1 Unit Per Acre	109	203	233
LDR: 4 Units Per Acre	938	1,898	2,080
MDR: 8 Units Per Acre	259	504	501
HDR: 15 Units Per Acre	325	2,345	5,419

B. WATER RESOURCES AND WATER QUALITY IN LAKE TAHOE HYDROGRAPHIC BASIN

TABLE B-1

EXISTING STORAGE RESERVOIRS

Map No.	Name	County	Source	Acres Maximum Surface	AF Maximum Capacity	Year Comp.	Major Use
69	Incline Lake^{-}	Washoe	Third Creek	30	157	1939	R
70	Price Lake^{o}	Washoe	Ophir Creek	10	54	Unk.	I
71	Washoe Lake^{o}	Washoe	Franktown & Ophir Creek	5,800	31,000	1864	I, F & W, R
72	Hobart Lake^{o}	Washoe	Hobart Creek	10	110	1875	M & I, F & W
73	Marlette Lake^{-}	Washoe	Marlette Basin	381	11,800	1877	F & W, M & I
74	Spooner Lake^{-}	Douglas	N. Canyon Creek	100	1,580	1882	R
75	Lake Tahoe^{-}	El Dorado Placer, Carson City, Douglas	Lake Tahoe Basin	124,000	744,600	1874	I, R, P, FC, M & I, F & W
76	Stony Ridge Lake^{-}	El Dorado	Meeks Creek	57	315	Unk.	F & W, R
77	Quail Lake^{-}	El Dorado	Springs	14	70	Unk.	M & I
78	Heather Lake^{-}	El Dorado	Glen Alpine Creek	37	142	Unk.	F & W, R
79	Fallen Leaf Lake^{-}	El Dorado	Glen Alpine Creek	1,380	6,800	Unk.	F & W, R
80	Susie Lake^{-}	El Dorado	Glen Alpine Creek	36	99	Unk.	F & W, R
81	Gilmore Lake^{-}	El Dorado	Glen Alpine Creek	78	320	Unk.	F & W, R
82	Echo Lake^{-}	El Dorado	----	338	1,900	Unk.	F, R, F & W
83	Round Lake^{-}	El Dorado	Upper Truckee River	41	300	Unk.	F & W, R
92	Dangberg #1 & 2^{o}	Douglas	E. Carson River	45	375	1905	I
93	Dangberg #3^{o}	Douglas	E. Carson River	80	500	1905	I
94	Dangberg #4^{o}	Douglas	E. Carson River	150	1,000	1905	I
95	Bosc^{o}	Douglas	Tailwater	30	90	1882	I
96	Mud Lake^{o}	Douglas	Indian Creek	300	3,252	1879	I
97	Scott Lake^{o}	Alpine	Scott Creek	30	600	1926	I, R
98	Harvey Lake^{o}	Alpine	Unnamed	17	410	Unk.	I
99	Crater Lake^{o}	Alpine	Crater Lake Creek	20	320	1937	I, R
100	Indian Creek^{o}	Alpine	Indian Creek	160	3,130	1967	I, R
101	Red Lake^{o}	Alpine	Red Lake Creek	85	1,410	1924	I, R
102	Forestdale^{o}	Alpine	Forestdale Creek	36	594	Unk.	I, R

Source: U.S. Bureau of Reclamation, Nevada State Engineer, Calif. Dept. of Water Resources, Calif., State Water Resources Control Board, U.S. Geological Survey, Calif. Dept. of Fish & Game, Susan River Decree, Nev. Dept of Fish & Game, USDA River Basin Staff, Walker River Decree, Truckee River Decree.

Legend: I, Irrigation; R, Recreation; P, Power; FC, Flood Control; M&I, Municipal & Industrial Water; F & W, Fish & Wildlife; SR, Sediment Reduction.

- Tahoe Basin
o Carson Basin

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C. NATURAL RESOURCES AND ENVIRONMENTAL QUALITY IN LAKE TAHOE HYDROGRAPHIC BASIN

1. BIOLOGY

VEGETATION

Vegetational Communities

Of the many studies of the vegetation of the Sierra Nevada (Storer and Usinger, 1963; Munz and Keck, 1978; Rundell, Parsons, and Gordon, 1977) and the Lake Tahoe Basin (Orr, 1971; Neilson, 1973; Smith, 1973), the TRPA/USFS, 1971 report provides the most detailed information on distributions of vegetational communities (1971i). This report, with some modifications, has been used as the basis for the following classifications of plant communities.

Aquatic and Marsh Communities. Aquatic vegetation grows to depths of 400 feet in Lake Tahoe (TRPA/USFS, 1971b; Moyle, 1976). This is possible only because of the outstanding clarity of the water, which admits sufficient light for deepwater photosynthesis. Algae such as Cladophora occupy the deepest zones. In the shallower regions, mosses (Fissodens, Hygrohphyphum, Leptodictyon), liverworts (chiloscyphus), and aquatic flowering species grow as well. The offshore shelf at the southern end of the lake supports extensive beds of submerged plants, including species of Photomogeton (TRPA/USFS, 1971b).

Algae populations increase as the water circulates from west to east along the south shore of the lake and receives nutrient-bearing runoff from the developed uplands (Davis, pers. comm.). The aquatic plant productivity was 25 percent greater in 1971 than in 1967, and the increase since 1959 has been more than twice this amount (PBRMG, 1978; USFS/TRPA, 1971b). These changes are attributed to urban runoff from development.

The vegetation in the other lakes and streams of the Lake Tahoe Basin is not well known TRPA/USFS, 1971b). Several emergent species including quillworts (Isoetes spp.), sedges (Carex spp.), and bur-reed (Sparganium angustifolium) have been listed (USFS/TRPA, 1971i). Dense stands of such plants form marshes, which tend to be highly productive. A particularly important community is the Truckee Marsh at the mouth of the Upper Truckee River. This wetland, composed of nearly pure stands of bulrush (Scirpus spp.), rushes (Juncus spp.), and, in the drier areas, grasses, is extensively used by waterfowl (Orr, 1971).

Meadows and Bogs. Meadows are found where the soil is too shallow or too continuously moist to support wood vegetation (Ornduff, 1974). The wet variety form where decomposed granitic soils have filled depressions in the bedrock substrate. They gradually dry out, change in composition, and are eventually colonized by forest trees (Storer and Usinger, 1963). There is some shift in vegetative cover from the wet to the dry type as summer progresses and water becomes less available. Lodgepole pine (Pine contorta ssp. murrayana) is the typical invading species.

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Wet meadows constitute one of the most valuable biological resources in the Lake Tahoe watershed. Not only do they provide excellent wildlife habitat, but recent work has shown that they can improve the quality of water flowing across them as well (Morris, pers. comm.). (This is discussed in more detail under 'Unique or Sensitive Areas'.)

Spagnum bogs are typified by such vascular plants as mountain laurel (*Kalmia polifolia* var. *microphylla*), bog orchid (*Habenaria* spp.), and sedges (*Carex* spp.), as well as the dominant mosses. They are found in scattered locations throughout the basin, especially around the perimeters of high-altitude lakes. They are considered "azonal communities," that is, their characteristics are essentially the same wherever they occur (Neilson, 1973). Two bogs of this type, Grass Lake and Osgood Swamp, are unique natural areas.

Streamside Vegetation. The open-water, marsh, meadow, and bog communities are not isolated from the remaining biological associations in the study area. They affect and are affected by organisms and physical processes in the adjacent upland. For example, broadleaf woodland and riparian shrub grow on the banks of streams in response to the greater availability of water. The vegetation, in turn, shades the water courses, thus controlling temperature and available light for algal photosynthesis. The leaf litter that falls into the streams decomposes, releasing nutrients that are an important food source for aquatic invertebrates.

Thickets of willows (*Salix eastwoodii*, *Salix jepsonii*), heathers (*Phylladoce breweri*, *Cassiope mertensiana*), and sedges are found at the highest elevations. Mountain alder (*Alnus tenuifolia*), bitter cherry (*Populus emarginatus*), serviceberry (*Amelanchier* spp.), American dogwood (*Cornus stolonifera*), and mountain ash (*Sorbus sitchensis*), and quaking aspen (*Populus tremuloides*) are found at lower altitides. Black cottonwood (*Populus trichocarpa*) and willows (*Salix scouleriana*, *Salix lasiandra*, *Salix lemmoni*) are important streamside species in the lowest reaches of the Lake Tahoe Basin.

Alder, a genus found in many North American wetlands, frequently grows in pure, dense stands in seepage areas throughout the study area. A number of herbaceous species, including ragwort (*Senecio triangularis*), western columbine (*Alguilegia formosa*), and paintbrush (*Castilleja miniata*) also grow in these areas.

Conifer Forest. Conifer forests in the Lake Tahoe Basin include several community types. The associations at lowest altitudes roughly correspond to the pure pine association and the mixed conifer community (TRPA/USFS, 1971i). These associations are dominated by Jeffrey pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), and white fir (*Abies concolor*). Incense cedar (*Calocedrus decurrens*) is found in warmer, drier locations, and red fir (*Abies magnifica*) occupies more shaded areas. Western juniper (*Juniperus occidentalis*) grows with the pines near Meyers and at scattered points around the lake shore. Typical understory species include huckleberry oak (*Quercus vaccinfolia*), greenleaf manzanita (*Arctostaphylos patula*), and tobacco brush (*Ceanothus velutinus*). The forests on the east side of the basin receive less precipitation and retain annual snowpack for a shorter period than those to the west. Their understory is composed of the bitterbrush (*Purshia Tridentata*), sagebrush (*Artemesia tridentata*), and rabbitbrush (*Chrysothammus nauseosus*), complexes typical of the adjacent, semi-arid Carson Valley.

Lodgepole pine (Pinus contorta spp. murrayana) is an important tree in two habitat types. It invades the margins of wet meadows and bogs, eventually converting them to lodgepole pine forest. It also occurs in regions with shallow soils and is an important early-successional component of fir and mixed conifer forests above 6,400-feet elevation.

Red fir becomes more abundant and white fir decreases at successively higher elevations. Similarly, western white pine (P. monticola) gradually replaces lower-elevation pine species. As in the lower altitude forests, the flora of the middle altitudes on the eastern rim of the basin is influenced by drier conditions and the nearby Great Basin. Desert mountain mahogany (Cercocarpus ledifolius) occurs here along with the understory shrubs typical of lower elevations.

Above 8,000 feet, soils are shallow, the growing season is short, and the vegetation is variable. Dense stands of mountain hemlock (Tsuga mertensiana) grow on volcanic soils, sometimes in association with red fir. Western juniper and the low-growing pinemat manzanita (Arctostaphylos nevadensis) grow on outcrops of bare rock. Open areas of glacially scoured granite support huckleberry oak, creambush (Holodiscus boursieri), and alpine juniper (Juniperus communis var. saxatilis). Plants of the heath family are abundant where the soil is moist, as around ponds or in pockets of alluvium. Whitebark pine (Pinus albicaulis), mountain hemlock, and occassional lodgepole pine are found at higher altitudes and in more exposed locations than other trees. Dense thickets of wind-pruned whitebark pine grow just below the distinctive alpine zone.

Alpine and Subalpine. The highest elevations (above 9,800 feet) are characterized by communities of scattered herbaceous plants. These alpine communities support fleabanes (Erigeron spp.), Sierra chaenactis (Chanenactis nevadense), penstemon (Penstemon davidsonii), and many other species.

Montane Chaparral. Chaparral communities in the study area occur where fire or timber cutting has eliminated the forest overstory (Neilson, 1973). Dominant species are similar to the understory in nearby forest regions. Greenleaf manzanita and tobacco brush are the most abundant components of this association. Huckleberry oak, snowbush (Symphoriocarpus spp.), and chinquapin (Castanopsis chrysophylla) are also present. Willows, serviceberry, and bitter cherry occur in seepage areas. On the eastern side of the basin, shrub communities are frequently dominated by sagebrush or mixtures of sagebrush and currant (Ribes spp.) (Orr, 1971; Neilson, 1973).

TABLE C-1

REPRESENTATIVE SPECIES OF VEGETATION[1]
LAKE TAHOE BASIN

AQUATIC AND MARSH COMMUNITIES

Open Water

Deepwater algae

- *Chara contraria*
- *C. delicatula* var. *annulata*
- *C. delicatula* var. *barbata*
- *Cladophora glomerata*
- *Schizothrix calciocola*
- *Vaucheria* sp.

Shallow water algae

- *Chara delicatula* var. *annulata*
- *Microspora wittrockii*
- *Spirogyra* sp.

Deepwater mosses

- *Brachythecium* sp.
- *Eurhynchium* sp.
- *Fissdens adiantoides*
- *F. grandifrons*
- *Fontinalis nitada*
- *Hygrophypnum* sp.
- *H. molle*
- *Leptodictyum riparium*
- *L. riparium* (forma) *fluitans*
- *Porothamnium bigelovii*

Deepwater liverworts

- *Blepharostoma arachanoideum*
- *Chiloscyphus fragilis*

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[1] Modified from TRPA/USFS 1971a, 1971i.

Other sources of information: TRPA/USFS, 1971b, 1971(b); Orr, 1971; Smith, 1973; Munz & Keck, 1968.

TABLE C-1 (Continued)

Higher plants

Carex spp.
Elodea canadensis
Isoetes bolanderi
I. muricata var. *hesperia*
Myriophyllum sp.
Potamogeton crispus
P. richardsonii

Marsh

Caltha howellii
Carex rostrata
C. vesicaria
Glyceria borealis
G. elata
Isoetes braunii
Nymphaea polysepala
Scirpus sp.
Sparganium angustifolium

MEADOWS AND BOGS

Wet Meadow

Aira caespitosa
A. elongata
Aster alpegius
Carex abrupta
C. heteroneura
C. illota
C. leporinella
C. nervina
Danthonia americana
Dodecatheon jeffreyi
Juncus mertensianus
Luzula intermedia
L. subcongesta
Mimulus guttatus
M. primuloides
Scirpus congdonii

TABLE C-1 (Continued)

Wet-Mesic Meadow

Agoseris glauca
Agrostis ampla
Aira caespitosa
Aster alpigenus
A. integrefolius
Brodiaea hyacintha
Calamagrostis spp.
Carex spp.
Erigeron coulteri
E. peregrinus
Hordeum brachyantherium
Ligusticum grayi
Perideridia parishii
Phleum alpinum
Poa pratensis
Polemonium occidentalis
Sidalcea oregana
Trifolium longipes
Veratrum californicum

Mesic Meadow

Agoseris glauca
Balsamorhiza sagittata
Brodiaea lutea var. *ixiodes*
Bromus carinatus
Chaenactis douglasii
Chalochortus leichthinii
Elymus canadensis
Eriogonium latifolium var. *nudum*
Gayophytum nuttallii
Hackelia longituba
Helianthella californica
Ipomopsis aggregata
Melica bulbosa
Monardella odoratissima
Potentilla glandulosa
Pterixia terebinthina
Sidalcea glaucescens
Sitanion hysterix
Stipa californica
Wyethia mollis

TABLE C-1 (Continued)

Sphagnum Bog

Agrostis thurberiana
Carex kelloggii
C. ormantha
C. vesicaria
Drosera rotundifolia
Dulichium arundinaceum
Glyceria elata
Habenaria dilatata
Juncus longistylus
Kalmia polifolia
Lonicera cauriana
Potamogeton gramineus
Potentilla palustris
Salex lemmonii
Valeriana occidentalis

STREAMSIDE VEGETATION

Willow and Alder Thicket

Alnus tenuifolia
Aquilegia formosa
Arnica amplexicaulis
Athyrium alpestre
Castilleja miniata
Cornus californica
Delphinium glauca
Epilobium hornmanei
Galium bifolium
Heuchera micrantha
Lupinus polyphylus
Mimulus guttatus
M. lewisii
Mitella breweri
Salix jepsonii
S. lasiandra
S. lemmonii
S. scouleriana
Sambucus racemosa spp.
Senecio triangularis
Sphenosciadium capitellatum

TABLE C-1 (Continued)

Broadleaf Woodland

Agastache urticifolia
Alnus tenuifolia
Cornus californica
C. sessilis
Heracleum lanatum
Lonicera conjugialis
Populus tremuloides
P. trichocarpa
Rubus parviflorus
Salix lasiandra
S. scouleriana
Senecio triangularis
Sphenosciadium capitellatum

CONIFER FOREST

Pine

Abies concolor
Agastache urticifolia
Artemisia tridentata
Balsamorhiza sagittata
Ceanothus cordulatus
Monardella odoratissima
Penstemon deustus
Phacelia mutabilis
Pinus contorta var. *murryana*
P. jeffreyi
P. ponderosa
Wyethia mollis

Mixed Conifer

Abies concolor
A. magnifica
Agastache urticifolia
Arctostaphylos patula
Balsamorhiza sagittata
Castinopsis sempervirens
Ceanothus cordulatus
C. velutinus

TABLE C-1 (Continued)

Chaenactis douglasii
Chrysopsis breweri
Libocedrus decurrens
Mimulus breweri
Monardella ordoratissima
Penstemon deustus
Phacelia mutabilis
Pinus contorta var. *murryana*
P. jeffreyi
P. lambertiana
P. ponderosa
Prunus emarginata
Purshia tridentata
Quercus vaccinifolia
Sitanion hystrix
Stephanomeria lactucina
Symphoricarpos acutus
Wyethia mollis

Fir

Abies concolor
A. magnifica
Chimaphila umbellata
Chrysopsis breweri
Hieracium albiflorum
Kelloggia galloides
Lupinus andersoni
Osmorrhiza chilensis
Pedicularis semibarbata
Pinus jeffreyi
P. monticola
Pterospora andromedea
Ribes roezlii
R. viscosissimum
Symphoricarpos acutus
Tsuga mertensiana

Lodgepole Pine

Agrostis ampla
Aira caespitosa
Alnus tenuifolia
Arabis holbellii
Arnica diversifolia
Aster occidentalis
Calamagrostis spp.
Carex nebraskensis
C. rossi
Lymus canadensis
Equisetum arvense

TABLE C-1 (Continued)

Hordeum brachyantherum
Ligusticum grayi
Mimulus moschatus
Phacelia hydrophylloides
Pinus contorta var. *murrayana*
Poa bolanderi
Potentilla glandulosa
Salix scouleriana
Senecio triangularis
Sphenosciadium capitellatum
Trifolium cyathiferum
Trisetum spicatum
Veratrum californicum
Viola purpurea

ALPINE AND SUBALPINE

Subalpine Forest

Chaenactis nevadensis
Erigeron barbellatus
Gilia leptalea
Juniperus occidentalis
Pedicularis groenlandica
Tsuga mertensiana

Alpine Communities

Anemone drummondii
Chaenactis douglasii
Erigeron barbellalatus
Eriogonum lobbii
E. nudum
Galium grayanum
Gayophytum nuttallii
Gilia leptalea
Haplopappus acaulis
Juncus mertensiana
J. nevadensis
Monardella odoratissima
Pedicularis groenlandica
Penstemon heterodoxus
Phacelia mutabilis
Polygonum davisiae
Primula suffrutescens
Ribes viscosissimum
Saxifraga bryophora
Sibbaldia procumbens
Viola purpurea

TABLE C-1 (Continued)

MONTANE CHAPARRAL

Oak-Manzanita

Arctostaphylos patula
Balsamorhiza sagittata
Castinopsis sempervirens
Ceanothus cordulatus
Chaenactis douglasi
Chrysothamnus spp.
Mimulus breweri
Prunus emarginata
Purshia tridentata
Quercus vaccinifolia
Sidalcea glaucescens
Sitanion hystrix
Stephanomeria lactucina
Symphoricarpos acutus
Wyethia mollis

Sagebrush

Artemisia arbuscula
A. tridentata
Cercocarpus ledifolius
Chrysothamnus nauseosus
Eriogonum mariflorum
E. umbellatum
E. wrightii
Mimulus coccineus
Purshia tridentata
Ribes sp.
Sitanion hystrix
Stipa lemmoni
Wyethia mollis

WILDLIFE

Wildlife Habitat

Aquatic and Marsh Communities. Open water is used by waterfowl and gulls for nesting and feeding, but it is of limited value for most terrestrial wildlife. Of great importance, however, are the associated shoreline marshes, which provide nesting habitat, foraging grounds, and other resources for waterfowl, wading birds, osprey, perching birds, reptiles and amphibians (herptiles), and a variety of small and medium-sized mammals (Reed, pers. comm.; Saake, pers. comm.). Prior to development, the Truckee Marsh at the south end of the lake was a productive nesting area, particularly for waterfowl (Orr, 1971).

Meadows and Bogs. Moist habitats, such as meadows, bogs, streamsides, and marshes, are the most valuable in the basin (Reed, pers. comm.). Meadows in particular provide favored fawning spots for the migratory deer herds of the basin (Wagner, pers. comm.; Fary, pers. comm.). Meadows are also aesthetically appealing and, as a consequence are subject to increasing recreational use, which disturbs wildlife, disrupts the shallow or moist soil, and adversely affects the vegetation (Reed, pers. comm.).

Streamside Zones. Like meadows and marshes, streamside areas are of critical wildlife value. Moist leaf litter accumulated under deciduous trees and shrubs is habitat for herptiles, shrews, and myriad insects (Small, 1974), which constitute a food source for other foraging animals. Where undisturbed by development, streamside vegetation creates habitat corridors connecting shoreline zones with upshore meadows and forests. These corridors are of critical importance for hunting, foraging, and territorial movements of many species of wildlife.

Conifer Forests. When winter snows blanket the Sierra, conifer forests furnish cone crops and evergreen cover to overwintering birds and mammals. Insect eggs deposited beneath the bark of the forest trees are also an important avian food source (Storer and Usinger, 1963). Of all the habitat types in the basin, this is the most widespread, and includes developed areas as well as remote back country. In general, the habitat values of coniferous forests are less sensitive to development pressure than the water-associated habitats discussed above.

Alpine and Subalpine. Because alpine and subalpine areas are characterized by bare outcroppings of rock and stunted vegetational growth, they are of limited value to wildlife. A few species, however, like the pika (Ochotona princeps) and grey-crowned rosy finch (Leucosticte tephrocotis) are adapted to these specialized habitats.

Montane Chaparral. Primary habitat attributes of the scrubby montane chaparral are the food resource provided by the fruits and nutritious browse of huckleberry oak, manzanita, cherry, and other shrubs and the protection against human intrusion afforded by the relatively impenetrable thick growth.

Urbanized Areas. Removal of vegetation and high degree of human activity in urbanized areas reduce habitat value for native wildlife. In some areas, careful construction and development has retained the forest canopy and preserved some of the habitat value, but destruction of understory, particularly along stream zones, has had an adverse effect. Landscape plantings, lawns, and seasonally occupied buildings attract some native wildlife and also support introduced species of birds and rodents. Feral or free roaming cats and dogs associated with human habitation can be significant predators on native animals (Reed, pers. comm.; Saake, pers. comm.).

Wildlife Populations

Mammals. Development of the Tahoe basin has reduced the populations of black bear (Euarctos americanus) and mountain lion (Felis concolor), although both species still occur in remote areas (TRPA/USFS, 1971j). Mule deer (Odocoileus hemionus) are most common.

Northern sections of the basin are used by the Verdi deer herd, and the Interstate-Carson River herd uses the southern end (Fary, pers. comm.). During the spring and summertime, the deer are evenly dispersed in suitable habitats, favoring meadows and thickets for fawning. In the fall, the deer congregate into small herds (15 to 35 members, or larger) and migrate out of the basin for the winter. The Interstate-Carson herd moves south, following migrating corridors across the Luther Pass to their wintering grounds near Indian Creek Reservoir (Reed, pers. comm.). Verdi deer also move out of the basin to the north and west, but their exact movements are not well understood (Fary, pers. comm.; Wagner, pers. comm.). Degradation of winter habitat is thought to be the cause of a recent decline in north basin deer populations (Wagner, pers. comm.).

Medium-sized mammal (furbearer) and small mammal populations are discussed in the TRPA/USFS (1971c) report. Wolverine (Gulo luscus), considered a rare species by the California Department of Fish and Game (1976), are probably inhabitants of remote and isolated areas of the basin. (Jeffress, pers. comm.; Reed, pers. comm.). Mountain beaver (Aplodontia rufa) are secretive residents of wet mountain meadows and are very sensitive to human disturbance (Herron, 1978; Jeffress, pers. comm.). Population data on river otter (Lutra canadensis) are scant, but this species may be found in some of the basin streams (Reed, pers. comm.).

Birds. A thorough consideration of the birds of the Lake Tahoe area is given in Orr (1971). Of special interest are certain raptorial species. Outside the basin, suitable deciduous habitat for accipitrine hawks (goshawk, cooper's hawk, sharp-shinned hawk) is restricted and uncommon in Nevada. The only nesting pair of osprey (Pandion haitaetus) in that state occur along the east shore of the lake (Herron, pers. comm.). Wintering bald eagles (Haliaeetus leucocephalus), an endangered species, frequent the Lake Tahoe shoreline (Reed, pers. comm.).

TABLE C-2

REPRESENTATIVE SPECIES OF WILDLIFE
LAKE TAHOE BASIN

MAMMALS

Common Name	Scientific Name
Vagrant shrew	*Sorex vagrans*
Water shrew	*S. palustris*
Trowbridge shrew	*S. trowbridgii*
Broad-handed mole	*Scapanus latimanus*
Little brown myotis	*Myotis lucifugus*
California myotis	*M. californicus*
Small-footed myotis	*M. leibii*
Pika	*Ochotona princeps*
White-tailed jackrabbit	*Lepus townsendii*
Snowshoe hare	*L. americanus*
Black-tailed jackrabbit	*L. californicus*
Nuttall's cottontail	*Sylvilagus nuttallii*
Mountain beaver	*Aplodontia rufa*
Least chipmunk	*Eutamias minimus*
Yellow pine chipmunk	*E. amoenus*
Townsend chipmunk	*E. townsendii*
Lodgepole chipmunk	*E. speciosus*
Long-eared chipmunk	*E. quadrimaculatus*
Yellow-bellied marmot	*Marmota flaviventris*
Belding ground squirrel	*Spermophilus beldingi*
California ground squirrel	*S. beecheyi*
Sierra Nevada golden-mantled ground squirrel	*S. lateralis*
Western gray squirrel	*Sciurus griseus*
Douglas' squirrel	*Tamiasciurus douglasii*
Northern flying squirrel	*Glaucomys sabrinus*
Northern pocket gopher	*Thomomys talpoides*
Mountain pocket gopher	*T. monticola*
Great Basin pocket mouse	*Perognathus parvus*
Beaver	*Castor canadensis*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse	*Peromyscus maniculatus*
Brush mouse	*P. boylii*
Pinyon mouse	*P. truei*

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[1] Based on information from Reed (pers. comm.), Herron (1978), TRPA/USFS (1971j), Burt and Grossenheider (1964), and Miller (pers. comm.). Nomenclature according to Jones *et al.* (1973).

TABLE C-2 (Continued)

Common Name	Scientific Name
Bush-tailed wood rat	*Neotoma cinerea*
Heather vole	*Phenacomys intermedius*
Montane vole	*Microtus montanus*
Long-tailed vole	*M. longicaudus*
Muskrat	*Ondatra zibethica*
House mouse	*Mus musculus*
Western jumping mouse	*Zapus princeps*
Porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
Red fox	*Vulpes vulpes*
Gray fox	*Ursus cinereoargenteus*
Black bear	*Euarctos americanus*
Raccoon	*Procyon lotor*
Marten	*Martes americana*
Fisher	*M. pennanti*
Ermine	*Mustela erminea*
Long-tailed weasel	*M. frenata*
Mink	*M. vision*
Wolverine	*Gulo luscus*
Badger	*Taxidea taxus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk	*Mephitis mephitis*
River otter	*Lutra canadensis*
Mountain lion	*Felis concolor*
Bobcat	*Lynx rufus*
Mule deer	*Odocoileus hemionus*

TABLE C-2 (Continued)

BIRDS[1]

Common Name	Scientific Name	Preferred Habitat[2]
Common loon	*Gavia immer*	W
Horned grebe	*Podiceps auritus*	W
Eared grebe	*P. nigricollis*	W
Western grebe	*Aechmophorus occidentalis*	W
Pied-billed grebe	*Podilymbus podiceps*	W
White pelican	*Pelecanus erythrorhynchos*	W
Great blue heron	*Ardea herodias*	W,R
Whistling swan	*Olor columbianus*	W
Canada goose	*Branta canadensis*	W
Mallard	*Anas platyrhynchos*	W
Gadwall	*A. strepera*	W
Cinnamon teal	*A. cyanoptera*	W
American wigeon	*A. americana*	W
Ring-necked duck	*Aythya collaris*	W
Canvasback	*A. valisneria*	W
Greater scaup	*A. marila*	W
Lesser scaup	*A. affinis*	W
Common goldeneye	*Bucephala clangula*	
Bufflehead	*B. albeola*	W
Ruddy duck	*Oxyura jamaicensis*	W
Common merganser	*Mergus merganser*	W
Turkey vulture	*Cathartes aura*	G,R,M,C,A
Goshawk	*Accipiter gentilis*	R
Sharp-shinned hawk	*A. striatus*	R
Cooper's hawk	*A. cooperii*	R
Red-tailed hawk	*Buteo jamaicensis*	G,R,A,M
Golden eagle	*Aquila chrysaetos*	R,C,M,A,G
Bald eagle	*Haliaeetus leucocephalus*	W,R
Marsh hawk	*Circus cyaneus*	G,W
Osprey	*Pandion haliaetus*	W
Prairie falcon	*Falco mexicanus*	R,W,M
Peregrine falcon	*F. peregrinus*	R,W
American kestrel	*F. sparverius*	R,G

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[1] Based on information from Reed (pers. comm.), Herron (1978), TRPA/USFS (1971j), Small (1974), Orr and Moffitt (1971), and Heilbrun *et al* (1976, 1977).

[2] W = Open Water and Marshes
G = Meadows and Bogs
R = Streamside Vegetation
C = Conifer Forests
A = Alpine and Subalpine
M = Montane Chaparral
U = Urban

TABLE G-2 (Continued)

Common Name	Scientific Name	Preferred Habitat
Blue grouse	*Dendrogapus obscurus*	C
Mountain quail	*Oreortyx pictus*	M
American coot	*Fulica americana*	W
Killdeer	*Charadrius vociferus*	G,U,W
Spotted sandpiper	*Actitis macularia*	W
Herring gull	*Larus argentatus*	W
California gull	*L. californicus*	W
Ring-billed gull	*L. delawarensis*	W
Forster's tern	*Sterna forsteri*	W
Band-tailed pigeon	*Columba fasciata*	C,R,M
Mourning dove	*Zenaida macroura*	R,M,U
Screech owl	*Otus asio*	R
Great horned owl	*Bubo virginianus*	R,C
Pygmy owl	*Glaucidium gnoma*	C
Saw-whet owl	*Aegolius acadicus*	C
Common nighthawk	*Chordeiles minor*	R,U
Rufous hummingbird	*Selasphorus rufus*	C
Belted kingfisher	*Megaceryle alcyon*	G,W,R
Common flicker	*Colaptes auratus*	R,C
Pileated woodpecker	*Dryocopus pileatus*	C
Lewis' woodpecker	*Melanerpes lewis*	R,C
Yellow-bellied sapsucker	*Sphyrapicus varius*	R
Hairy woodpecker	*Picoides villosus*	R,C
Downy woodpecker	*P. pubescens*	R,C
White-headed woodpecker	*P. albolarvatus*	C
Black-backed three-toed woodpecker	*P. articus*	C
Ash-throated flycatcher	*Myiarchus cinerascens*	R
Hammond's flycatcher	*Empidonax hammondii*	C
Dusky flycatcher	*E. oberholseri*	C
Western wood pewee	*Contopus sordidulus*	R,C
Violet-green swallow	*Tachycinetta thalassina*	R,C
Tree swallow	*Iridioprocne bicolor*	G,R,C
Bank swallow	*Riparia riparia*	G,R
Rough-winged swallow	*Stelgidopteryx ruficollis*	W,G,R
Cliff swallow	*Petrochelidon pyrrhonota*	G,R
Steller's jay	*Cyanocitta stelleri*	C,M,A,U
Scrub jay	*Aphelocoma coerulescens*	G,M,U
Black-billed magpie	*Pica pica*	G,R,A
Clark's nutcracker	*Nucifraga columbiana*	C
Mountain chickadee	*Parus gambeli*	C
Bushtit	*Psaltriparus minimus*	R,C

TABLE C-2 (Continued)

Common Name	Scientific Name	Preferred Habitat
White-breasted nuthatch	*Sitta carolinensis*	C
Red-breasted nuthatch	*S. canadensis*	C
Pygmy nuthatch	*S. pygmaea*	C
Brown creeper	*Certhia familiaris*	C
Dipper	*Cinclus mexicanus*	R
House wren	*Troglodytes aedon*	M
Bewick's wren	*Thryomanes bewickii*	M
Long-billed marsh wren	*Cistothorus palustris*	W
Rock wren	*Salpinctes obsoletus*	A
American robin	*Turdus migratorius*	C,A,R,U,G
Varied thrush	*Ixoreus naevius*	C
Hermit thrush	*Catharus guttatus*	C
Swainson's thrush	*C. ustulatus*	R
Western bluebird	*Sialia mexicana*	R,M,A,G
Mountain bluebird	*S. currucoides*	R,G
Townsend's solitaire	*Myadestes townsendi*	C
Golden-crowned kinglet	*Regulus satrapa*	R,C
Water pipit	*Anthus spinoletta*	G
Starling	*Sturnus vulgaris*	U,G
Warbling vireo	*Vireo gilvus*	R
Orange-crowned warbler	*Vermivora celata*	M,R
Yellow warbler	*Dendroica petechia*	R
Yellow-rumped warbler	*D. coronata*	R,C
Macgillivray's warbler	*Oporornis tolmiei*	M,R
Yellow-breasted chat	*Icteria virens*	R
Wilson's warbler	*Wilsonia pusilla*	R
House sparrow	*Passer domesticus*	U
Western meadowlark	*Sturnella neglecta*	G,U
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	W,R
Red-winged blackbird	*Agelaius phoeniceus*	W,R,G
Brewer's blackbird	*Euphagus cyanocephalus*	G,R,U
Western tanager	*Piranga ludoviciana*	C
Lazuli bunting	*Passerina amoena*	R,M
Evening grosbeak	*Hesperiphona vespertina*	C,A
Cassin's finch	*Carpodacus cassinii*	C
Pine grosbeak	*Pinicola enucleator*	A
Gray-crowned rosy finch	*Leucosticte tephrocotis*	A
Pine siskin	*Carduelis pinus*	C,A
Lesser goldfinch	*C. psaltria*	R,G
Red crossbill	*Loxia curvirostra*	C,A
Green-tailed towhee	*Pipilo chlorura*	M,C
Rufous-sided towhee	*P. erythrophthalmus*	M,R,U

TABLE C-2 (Continued)

Common Name	Scientific Name	Preferred Habitat
Savannah sparrow	*Passerculus sandwichensis*	G
Dark-eyed junco	*Junco hyemalis*	C,A
Chipping sparrow	*Spizella passerina*	C
Brewer's sparrow	*S. breweri*	M
White-crowned sparrow	*Zonotrichia leucophrys*	G,M
Golden-crowned sparrow	*Z. atricapilla*	C,A,R
Fox sparrow	*Passerella iliaca*	R,C
Song sparrow	*Melospiza melodia*	G,R

Table C-2 (Continued)

REPTILES AND AMPHIBIANS[1]

Common Name	Scientific Name
Great Basin spadefoot	*Scaphiopus intermontanus*
Boreal toad	*Bufo boreas boreus*
California toad	*B. b. halophilus*
Pacific treefrog	*Hyla regilla*
Leopard frog	*Rana pipiens*
Northwestern pond turtle	*Clemmys marmorata marmorata*
Great Basin fence lizard	*Sceloporus occidentalis biseriatus*
Northern sagebrush lizard	*S. graciosus graciosus*
Western skink	*Eumeces skiltonianus*
Sierra alligator lizard	*Gerrhonotus coeruleus palmeri*
Pacific rubber boa	*Charina bottae bottae*
Rocky Mountain rubber boa	*C. utahensis*
Striped whipsnake	*Masticophis taeniatus*
Racer	*Coluber constrictor*
Great Basin gopher snake	*Pituophis melanoleucus deserticola*
Kingsnake	*Lampropeltis getulus californiae*
Valley garter snake	*Thamnophis sirtalis fitchi*
Mountain garter snake	*T. elegans elegans*
Sierra garter snake	*T. couchi couchi*
Great Basin rattlesnake	*Crotalus viridis lutosus*

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[1] Based on information from Stebbins (1966) and Miller (pers. comm.).

FISH

Fish Habitat and Populations

Because Lake Tahoe drains into Pyramid Lake east of the Sierra Nevada, it is considered part of the Lahontan system. Native fishes are similar to those of the Lahontan streams, but the ecological relationships of the lacustrine system are somewhat different (Moyle, 1976). The only native trout, the Lahontan cutthroat (*Salmo clarki henshawi*), now extinct in the lake, may have used Lake Tahoe only as a spawning area, returning to Pyramid Lake for the rest of the year (David, pers. comm.). Game fish in the lake include introduced lake trout (*Salvelinus namaycush*), eastern brook trout (*Salvelinus fontinalis*), rainbow trout (*Salmo gairdneri*), nonnative cutthroat trout (*S. clarki*), kokanee salmon (*Onchorynchus nerka*), brown trout (*S. trutta*), and the native mountain whitefish (*Prosopium williamsoni*) (Wickwire, pers. comm.; TRPA/USFS 1971b). Native nongame fish are the mountain sucker (*Pantosteus lahontan*), Lahonton redside (*Richardsonius egregius*), speckled dace (*Rhinichtyys osculus*), Piute sculpin (*Cottus beldingi*), Tahoe sucker (*Catostomus tahoensis*), and tui chub (*Gila bicolor*); introduced species include the golden shiner (*Notemigonus chrysoleucas*), brown bulhead (*Latalurus nebulosus*), and mosquito fish (*Gambusia affinis*) (TRPA, 1971b). Other fishes have been less successfully introduced into the lake in the past, and opossum shrimp were planted in the 1960s to provide trout forage (TRPA, 1971b).

2. NOISE

FUNDAMENTALS OF SOUND

Sound may be described by its three components: amplitude (loudness), frequency (pitch), and duration (time). The combination of these three factors produces what we hear. The strength of sound, or sound level, is measured in decibels (dB). It is a function of the sound pressure produced by sound waves emitted from some source. Decibel measurements are described more fully below in the section, Noise Measurement.

Frequency is measured in Hertz (Hz) (cycles per second). It is this parameter that enables us to distinguish a shrill whistle from a deep roar. However, the human ear does not hear all frequencies. Our normal hearing ranges from 20 Hz to 20,000 Hz or, roughly, from the lowest note on a great pipe organ to the highest note on a violin. The human ear also does not hear all sounds equally. Our ears are less sensitive to sounds of high and low pitch. Thus, very high and very low notes sound more faint to our ears than a sound in the middle of the audible range, even if all are of equal strength (same dB levels).

The length of time to which a person is exposed to sound is as important as loudness and pitch in determining how the sound is perceived. Continuous sounds are those produced by sources which emit the sound for relatively long periods in a constant state, such as the noise of a waterfall. Intermittent sounds are those produced for short periods, such as school noise, light traffic noise, and occasional aircraft flyover noise. Impulsive sounds are those produced in an extremely short span of time, such as a gunshot.

NOISE MEASUREMENT

Because hearing varies widely between individuals, what may seem loud to one person may not to another. Although loudness is a personal judgment, precise measurement of sound is made possible by use of the decibel scale. It measures sound pressure or energy according to international standards. The decibel scale is logarithmic (based on powers of ten), not linear like a ruler. Therefore, a small increase in decibels represents a great increase in intensity. The sound intensity multiplies by 10 with every 10-decibel increase, but the perceived sound level to an observer increases two-fold. For example, a 70 dB sound level is twice as "loud" as a 60 dB sound level. Table C-3 shows the decibel levels of common sounds and the associated human response.

Because the ear is less sensitive than measuring instruments to sounds of very high and low frequencies, decibel measurements can be weighted to correspond more closely to what the human ear hears. The most common modification is the A-weighted sound level, dBA. Measurements in dBA offer good indications of the intensity of sound but do not account for the duration component of noise.

Several systems have been devised to incorporate the duration component. The community Noise Equivalency Level (CNEL) provides an average equivalent A-weighted sound level for a 24-hour day. The day is divided into day, evening, and night and noises occurring during the evening and night periods are weighted to reflect that they are more obnoxious than daytime noises. Similarly, the L_{dn} system describes an average A-weighted sound level for a 24-hour day but eliminates the evening period.

TABLE C-3

SOUND LEVELS AND HUMAN RESPONSE

	Noise Level (dB)	Response	Hearing Effects	Conversational Relationships
Carrier deck jet operation	140	Painfully loud		
	130	Limit amplified speech	Contribution to Hearing Impairment Begins	
Jet takeoff (200 feet)	120			
Discotheque				
Auto horn (3 feet)		Maximum vocal effort		
Riveting machine	110			
Jet takeoff (2000 feet)				
Garbage truck	100			Shouting in ear
N.Y. subway station		Very annoying		
Heavy truck (50 feet)	90			Shouting at 2 feet
Pneumatic drill (50 feet)				
	80	Annoying		Very loud conversation, 2 feet
Alarm clock				
Freight train (50 feet)				
Freeway traffic (50 feet)	70	Telephone use difficult		Loud conversation, 2 feet
Air conditioning unit (20 feet)	60	Intrusive		Loud conversation, 4 feet
Light auto traffic (100 feet)	50	Quiet		Normal conversation, 12 fee
Living room				
Bedroom	40			
Library				
Soft whisper (15 feet)	30	Very quiet		
Broadcasting studio	20			
	10	Just audible		
	0	Threshold of hearing		

Source: Environmental Protection Agency, Noise Pollution: Now Hear This, 1974.

NOISE CONTROL EFFORTS

Local efforts at controlling noise sources are limited; however, there are instances where local agencies have made significant steps. In the regulation of noise levels on highways, local agencies are preempted by state and federal authority. However, restrictions on the operation of off-road vehicles are within local powers. Such noise sources can be controlled through restrictions on the time and areas of use and through the imposition of specific dBA limits. Essentially, this is what has been done in the TRPA Shorezone Ordinance, which has established noise limits on power boating. Aside from this ordinance, the only other effort to control noise through regulation is the draft Tahoe Noise Ordinance. This ordinance calls for a review of changes of land use for noise impacts; establishes exterior and interior noise limits; and requires a noise control officer to issue citations. The ordinance is included in the updated Regional Transportation Plan, but no action has been taken to adopt it.

In July 1977, CTRPA began a community noise monitoring project aimed at defining ambient noise levels in different neighborhoods of the city. The data has not yet been reduced or analyzed, although preliminary indications show that ambient noise levels are well within the state and federal guidelines and standards described immediately below. TRPA, in its 1979-1980 work program, anticipates performing some noise studies although details are not yet formulated (Bissell, pers. comm.).

State legislation pertinent to noise control is indicated in Table C-4.

At the federal level, EPA released in May 1977 its "Toward a National Strategy for Noise Control," which represents the first comprehensive national plan for reducing noise. It is aimed at reducing noise levels and helping other federal, state, and local agencies adopt and implement noise control policies. Other pertinent efforts at the federal level to control noise include the following:

> Pursuant to the Noise Control Act of 1972 (42 U.S.C. § 4904 (Supp. II, 1972)), EPA issued noise levels necessary to protect public health and welfare. Regulations cover construction equipment, transportation equipment, motors and electrical equipment. EPA has concluded that residential outdoor enjoyment is disturbed when L_{dn} is greater than 55 dBA, and indoor activities are disrupted when L_{dn} is greater than 45 dB.
>
> The Federal Aviation Regulations, Part 36 of the Federal Aviation Act became effective on December 1, 1969, and are the basis of maximum perceived ground noise levels for subsonic aircraft landings and takeoffs. The Federal Aviation Administration is requiring all aircraft to meet the 1968 aircraft noise standards. The Airport and Airway Development Act Amendments of 1976 broaden the funding eligibility for airport development projects to minimize noise level "impact zones" in the vicinity of airports.
>
> According to U.S. Department of Transportation standards issued in 1973, the following design noise levels apply to different land-use categories:

Unique and unusual tracts of land in which serenity and quiet are of extraordinary significance, and the preservation of these qualities is essential if the area is to continue to serve its intended purpose	60 dBA (exterior)

Residential areas, schools, churches, libraries, hospitals, etc.	70 dBA (exterior)
Other developed land not included in above categories and generally constituted by urbanized business or industrialized areas	75 dBA (exterior)

Note: The specific dBA levels should not be exceeded more than 10 percent of the time during which measurement is made.

TABLE C-4

STATE LEGISLATION REGULATING NOISE EMISSION LEVELS

Source	Legislation	Standard
Aircraft	California Administrative Code Section 5000-5080	70 dBA for urban residential areas in vicinity of airport.
Motor vehicles	California Vehicle Code Section 23130	Specific maximum dBA limits for operation of motor vehicles.
	Section 27150-27151	Noise limits on vehicle exhaust systems.
	Section 27200	Specific maximum dBA limit for sale of motor vehicles.
	Section 27201-2	Specific maximum dBA limits for manufacture of motorcycles.
	Section 27203	Specific maximum dBA limits for manufacture of snowmobiles.
	Section 38365	Muffler requirement for off-highway motor vehicles.
	Section 38370	Specific maximum dBA limits for sale of off-highway motor vehicles.
Motorboats	California Harbors and Navigation Code Section 654	Muffler requirement and specific maximum dBA limits for sale and operation of motorboats.

3. METEOROLOGY AND AIR QUALITY

CARBON MONOXIDE

General Description of the Method Approach

Four representative locations in the Lake Tahoe Hydographic Basin and one in the Upper Carson River Basin were chosen to analyze the impact of the five alternative growth scenarios. Of these, one was a congested intersection (Park Avenue and Highway 50 in South Lake Tahoe) and four were heavily traveled highways. Hypothetical receptors were placed at each location using the siting guidelines developed for EPA by Ludwig and Kealoha (1975); the receptors are intended to represent the likely microscale impacts of the roadway sections on CO levels. In considering such "hot spot" locations, the air quality effects from both adjacent roadway and the surrounding network were quantified in the analyses. The local CO contribution was computed using the indirect-source guidelines developed by Dabberdt and Sandys (1977) and subsequently revised by EPA (1978) to incorporate more recent automotive emission factors. "Background" CO levels at the sites were computed using the APRAC-2 dispersion model [Ludwig et al. (1977)] and consist of the sum of CO entering the Basin in the ambient air and CO generated by other traffic links upwind of the local roadway.

Base conditions for 1978 for the microscale portion of the analysis were obtained from several CALTRANS studies and reports (1978a,b; Baker, pers. comm.) and included both meteorological, air quality, and traffic data representative of worst-case conditions in the Basin. Microscale data from a CALTRANS study (1978a) at Highway 50 and Park Avenue were used first to evaluate the performance of the evaluation procedure. The poorest air quality conditions in terms of CO occur during winter and the available meteorological data from the Highway 50-Park Avenue site were subjectively extrapolated and modified to represent wind conditions at the other sites. This was done to take into account the persistent local wind circulations set up by drainage winds from the surrounding mountains and the land/lake breezes due to temperature differences between water and shore.

Projections of the local contribution to CO levels at the sites were made using the CALTRANS 1978 base traffic conditions (Baker, pers. comm.) and growth factors derived by Conradt (pers. comm.) to account for conditions in 2000 for each of the five scenarios. Roadway configurations were assumed to be unchanged from 1978 conditions for all sites except Highway 50 at Park Avenue where the design improvements recommended in a traffic study by Barton-Aschman and Pillsbury (1978) were "implemented".

Background levels at each of the sites were calculated from the basinwide contributions of all traffic links in addition to an assumed ambient background CO concentration of 0.8ppm. The APRAC-2 model requires speeds and volumes on all links and then uses these data to first calculate a regional grid of emissions for hydrocarbons, oxides of nitrogen, and carbon monoxide, and subsequently to calculate CO concentrations at specified locations after the appropriate meteorological data have been input. Base-year and future-year traffic inventories were provided by CALTRANS (1978b and 1979).

After the local and background contributions had been calculated at common receptor locations, the total CO concentration was obtained by taking the arithmetic sum of the two.

Dispersion Models

Indirect-Source Guidelines

The indirect-source guidelines are a manual procedure for rigorously calculating the emissions and dispersion of CO from continuous and discrete highway line sources, as well as parking lots. Rather than require the use of computing facilities, the guidelines use nomographs, tables, and figures. The overall scope of the procedure is outlined in Figure C-1.

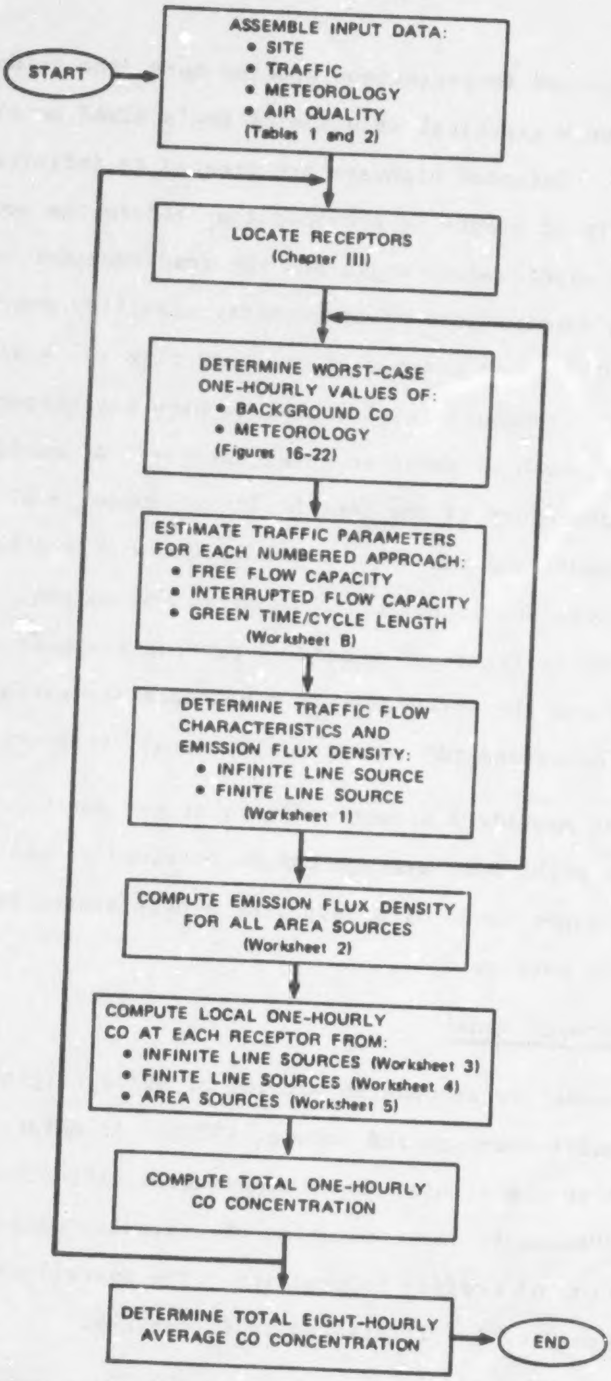

START
ASSEMBLE INPUT DATA:
• SITE
• TRAFFIC
• METEOROLOGY
• AIR QUALITY
(Tables 1 and 2)
LOCATE RECEPTORS
(Chapter III)
DETERMINE WORST-CASE ONE-HOURLY VALUES OF:
• BACKGROUND CO
• METEOROLOGY
(Figures 16-22)
ESTIMATE TRAFFIC PARAMETERS FOR EACH NUMBERED APPROACH:
• FREE FLOW CAPACITY
• INTERRUPTED FLOW CAPACITY
• GREEN TIME/CYCLE LENGTH
(Worksheet 8)
DETERMINE TRAFFIC FLOW CHARACTERISTICS AND EMISSION FLUX DENSITY:
• INFINITE LINE SOURCE
• FINITE LINE SOURCE
(Worksheet 1)
COMPUTE EMISSION FLUX DENSITY FOR ALL AREA SOURCES
(Worksheet 2)
COMPUTE LOCAL ONE-HOURLY CO AT EACH RECEPTOR FROM:
• INFINITE LINE SOURCES (Worksheet 3)
• FINITE LINE SOURCES (Worksheet 4)
• AREA SOURCES (Worksheet 5)
COMPUTE TOTAL ONE-HOURLY CO CONCENTRATION
DETERMINE TOTAL EIGHT-HOURLY AVERAGE CO CONCENTRATION
END

FIGURE C-1 ILLUSTRATED PROCEDURE FOR DETERMINING AMBIENT CO CONCENTRATIONS IN THE VICINITY OF INDIRECT SOURCES

For the highways and intersections studied here, the guidelines-procedure is based on a graphical solution of EPA's HIWAY model (Zimmerman and Thompson, 1975). Extended highways are treated as infinite line sources, and a family of graphs is provided that relate the normalized CO concentration to wind/roadway angle and the road/receptor separation for each of various combinations of atmospheric stability and terrain roughness. Figure C-2 is an example of one such figure. A similar though more involved procedure is also used to simulate dispersion from finite line sources, such as exist at intersections. An explicit consideration of the procedure is the length of the source (e.g. intersection-approach queue) and its orientation to the wind and the receptor. Figure C-3 illustrates the intersection geometry and nomenclature used in the procedure, while Figures C-4 and C-5 provide examples of the dispersion nomographs and the interpolation nomographs (to estimate the concentration at "non-standard" receptor distances), respectively.

The guidelines provide a direct estimate of the one-hour average concentration. An eight-hour average can be obtained by making calculations for all eight hours or by applying a persistence factor to the peak one-hourly average.

APRAC-2 Dispersion Model

The APRAC-2 model is an updated version of SRI's original APRAC-1A urban diffusion model (Mancuso and Ludwig, 1972). It maintains basically the same approach to the simulation of atmospheric diffusion, but incorporates recent advances in the estimation of vehicular emissions and in the dissemination of traffic information. The overall structure of APRAC-2 is schematically illustrated in Figure C-6.

The model has two major components; the diffusion module and the emissions module. The emissions module can be used alone, but

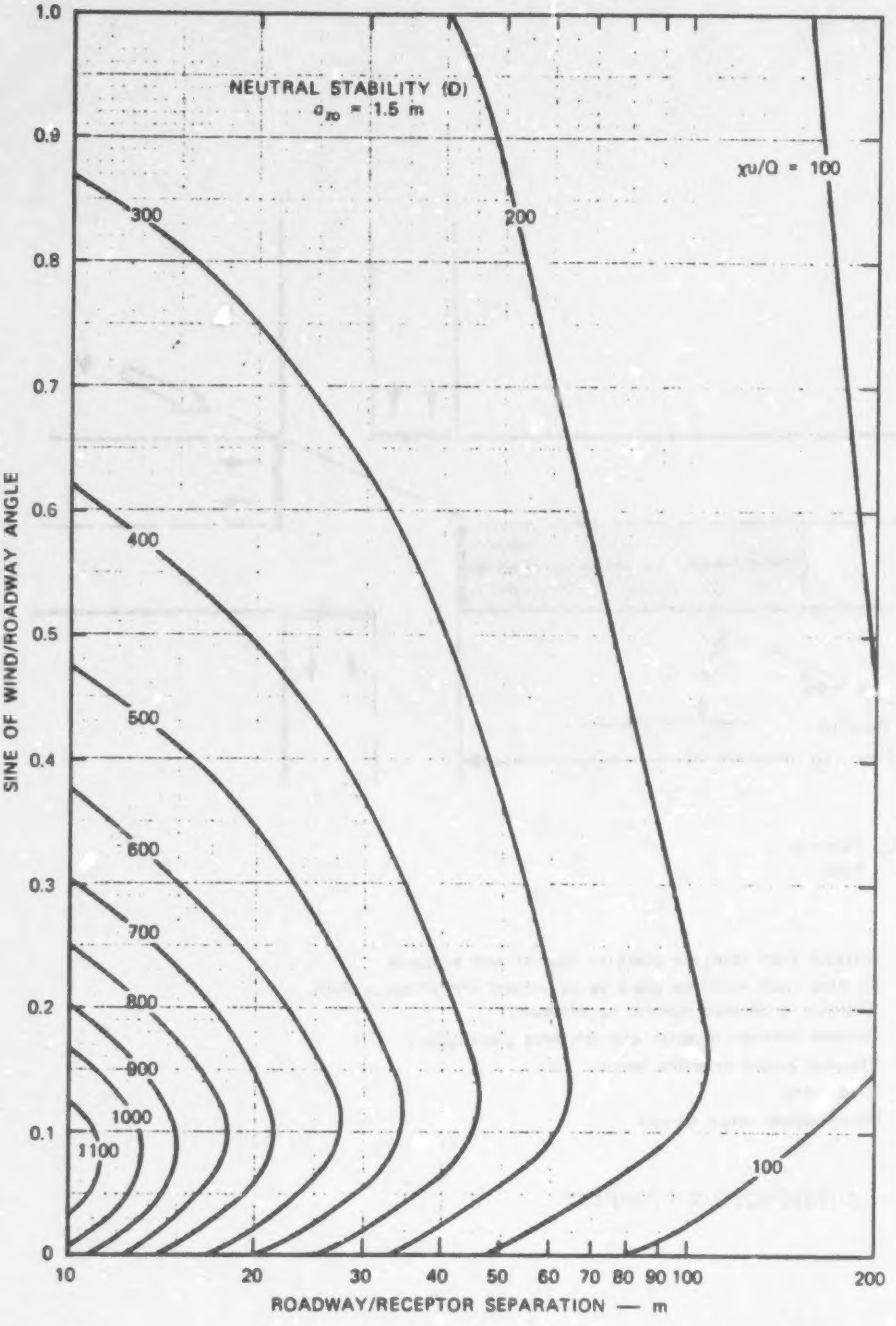
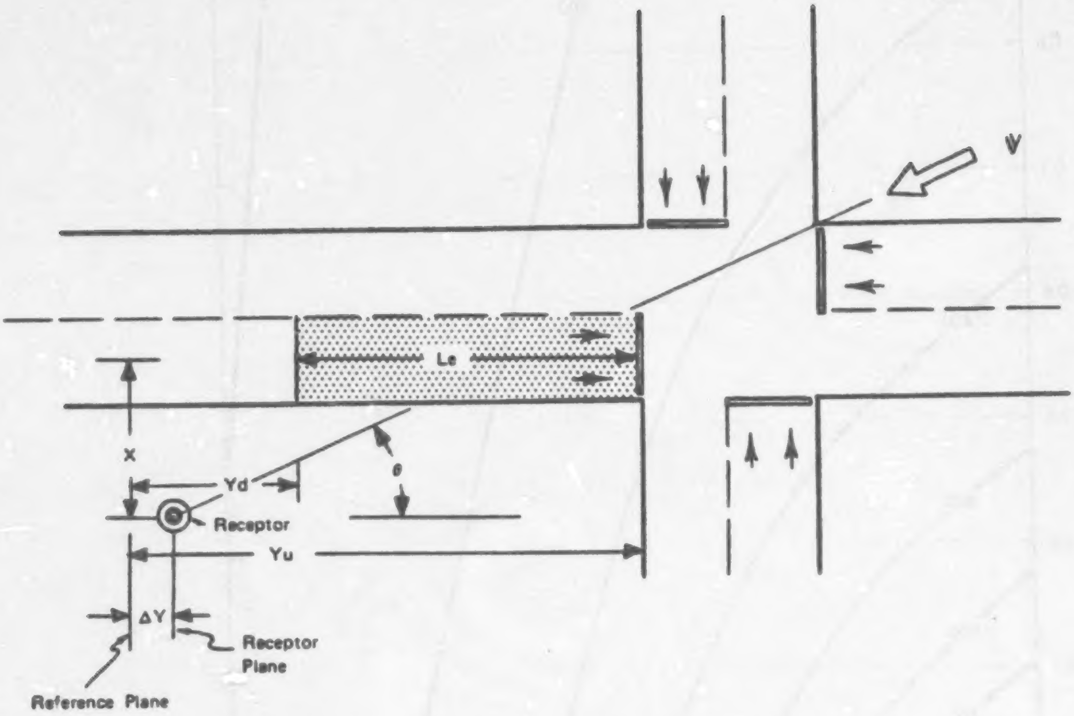


FIGURE C-2 VALUES $\chi u/Q$ $(10^{-3}m^{-1})$ FOR VARIOUS ROADWAY/RECEPTOR SEPARATIONS AND WIND/ROADWAY ANGLES; INFINITE LINE SOURCE



Yu = Distance from reference plane to upwind end of queue
Yd = Distance from reference plane to downwind end of queue (>0)
(Distance is denoted positive to windward)
ΔY = Distance between receptor and reference plane (20m)
Le = Effective excess emissions length
Ψ = Wind vector
θ = Wind/roadway angle (acute)

FIGURE C-3 INTERSECTION GEOMETRY

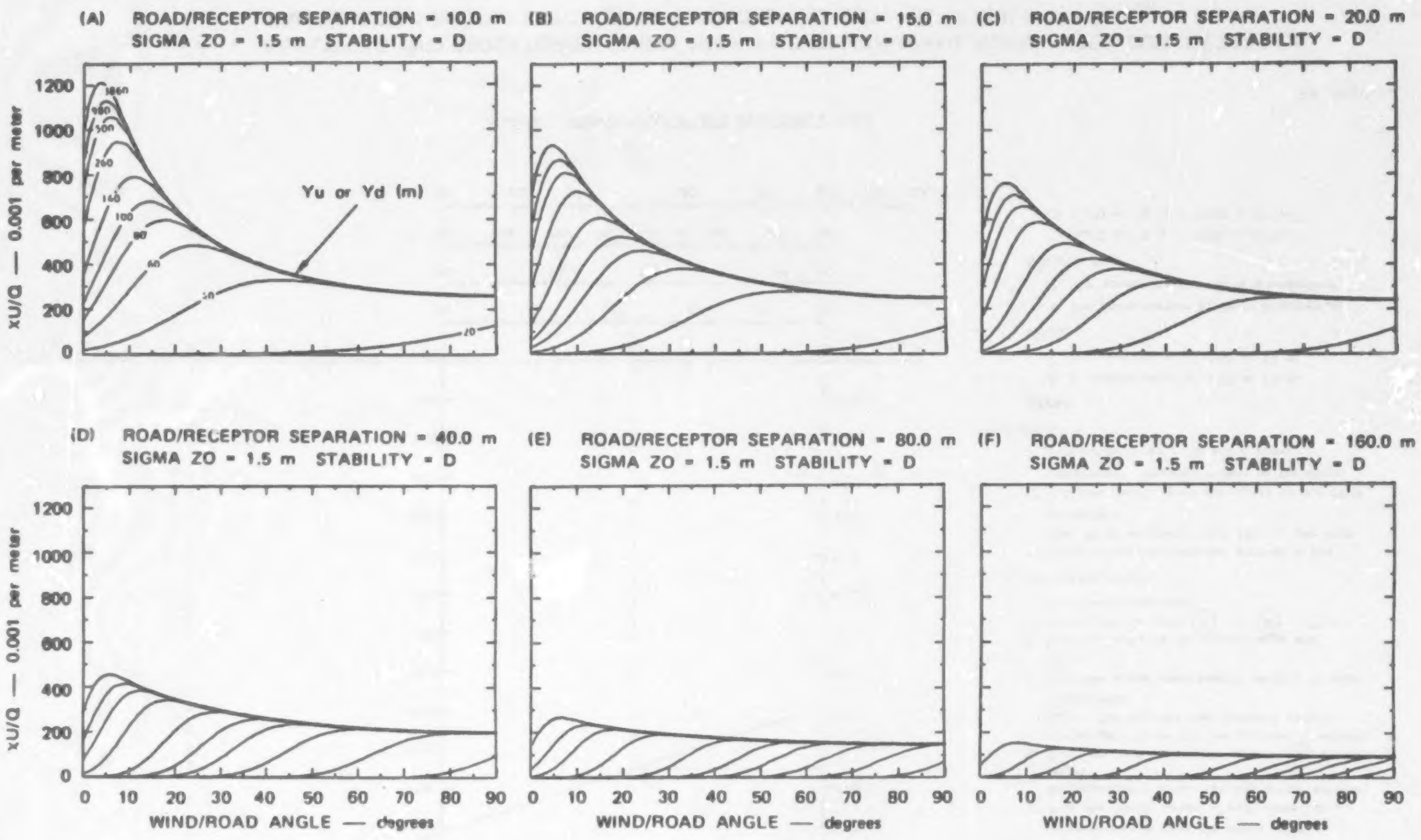
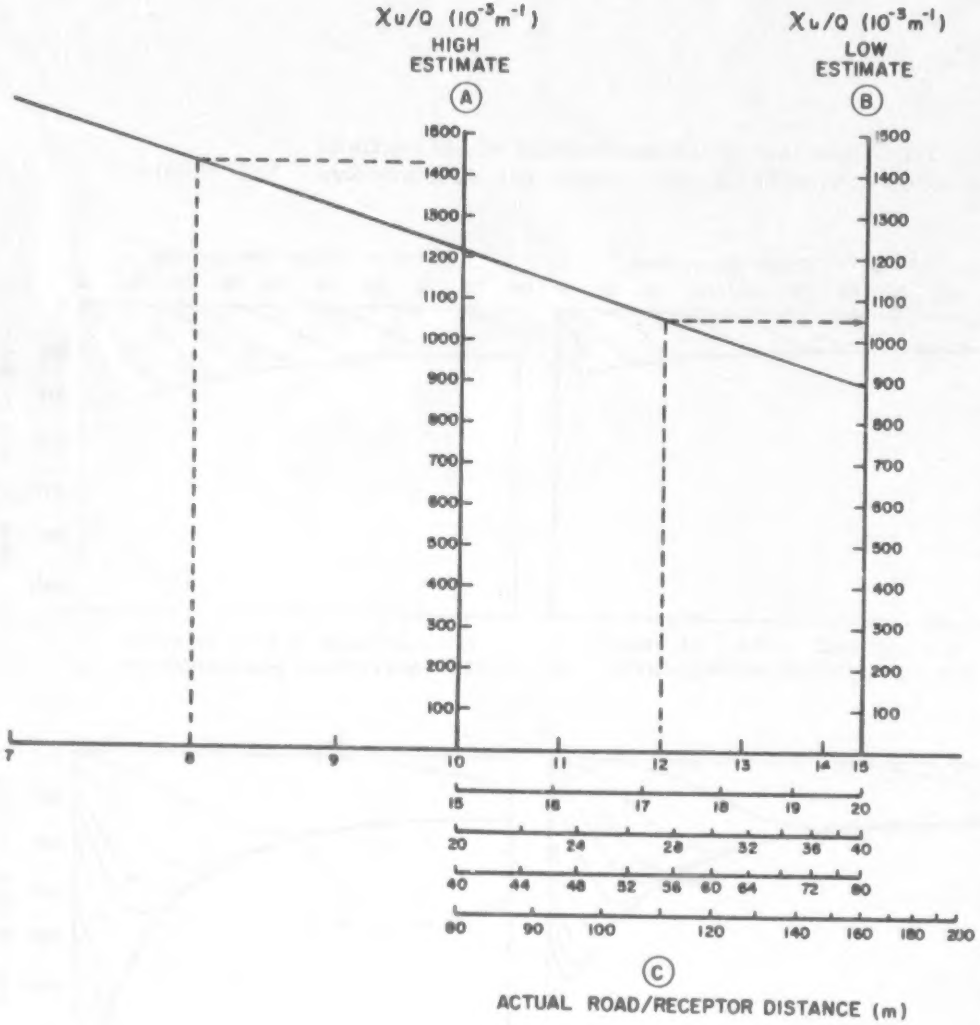


FIGURE C-4 VARIATION OF THE NORMALIZED CO CONCENTRATION WITH ROADWAY LENGTH, ROAD/RECEPTOR SEPARATION, STABILITY, WIND/ROAD ANGLE, AND TERRAIN ROUGHNESS



INSTRUCTIONS FOR USE:

This nomograph is used for calculating normalized concentration (xu/Q) estimates when the road/receptor distance is not one of the standard distances used in curves 12a.

- INTERPOLATION
  1. Select the (xu/Q) curves for road/receptor distances that bracket the actual value.
  2. Find the (xu/Q) values in each curve using the appropriate wind angle and excess emissions length.
  3. Enter the high estimate in column Ⓐ of the nomograph. Enter the low estimate in column Ⓑ Connect the two estimates with a straight-edge.
  4. Find the actual road/receptor distance in rows Ⓒ
  5. Move vertically to the straight-edge and horizontally to scale Ⓐ or Ⓑ This is the interpolated value.
- EXTRAPOLATION
  1. If the actual road/receptor distance is less than 10 m or greater than 160 m, you must extrapolate.
  2. Calculate (xu/Q) from the curves of the TWO road/receptor distances closest to the actual.
  3. Proceed to Steps 3, 4, and 5 above.

EXAMPLE:

GIVEN:

1. A concentration of 1.22 at 10 m
2. A concentration of 0.90 at 15 m

FIND:

1. The concentration at 12 m (interpolate)
2. The concentration at 8 m (extrapolate)

SOLUTION:

1. xu/Q at 12 m = 1050 x $10^{-3}m^{-1}$
2. xu/Q at 8 m = 1430 x $10^{-3}m^{-1}$

SA-4429-17

FIGURE C-5 NONLINEAR INTERPOLATOR/EXTRAPOLATOR FOR CALCULATING NORMALIZED CONCENTRATION VALUES FOR ROAD/RECEPTOR SEPARATIONS UP TO 200 m (D-STABILITY AND σ_{zo} = 1.5 m)

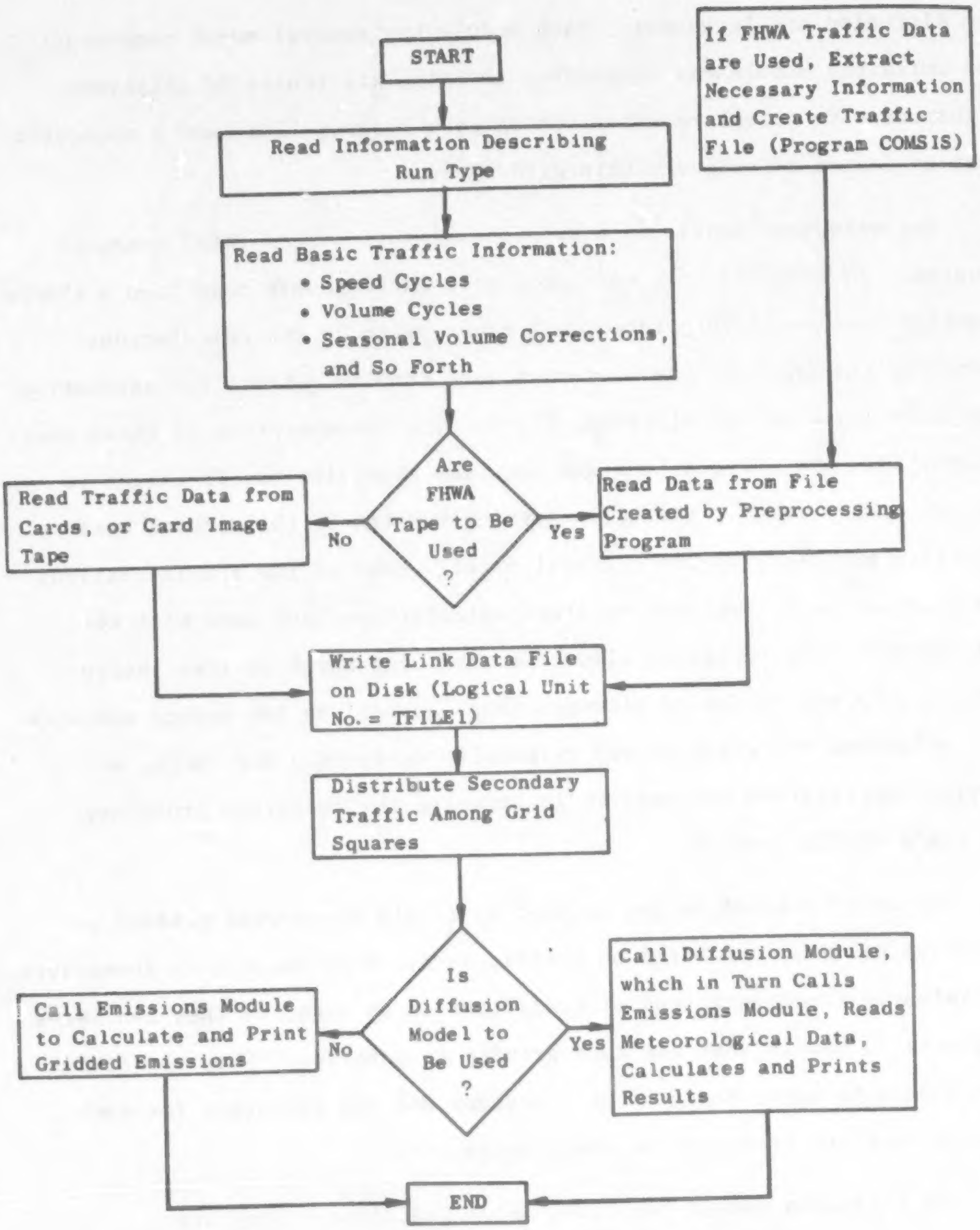

START
Read Information Describing Run Type
Read Basic Traffic Information:
• Speed Cycles
• Volume Cycles
• Seasonal Volume Corrections, and So Forth
If FHWA Traffic Data are Used, Extract Necessary Information and Create Traffic File (Program COMSIS)
Are FHWA Tape to Be Used ?
No
Yes
Read Traffic Data from Cards, or Card Image Tape
Read Data from File Created by Preprocessing Program
Write Link Data File on Disk (Logical Unit No. = TFILE1)
Distribute Secondary Traffic Among Grid Squares
Is Diffusion Model to Be Used ?
No
Yes
Call Emissions Module to Calculate and Print Gridded Emissions
Call Diffusion Module, which in Turn Calls Emissions Module, Reads Meteorological Data, Calculates and Prints Results
END

FIGURE C-6 SIMPLIFIED FLOW CHART OF APRAC-2 COMPUTER PROGRAM the diffusion module cannot. Each module has several major components. The emissions module has components to calculate tables of emissions, a component to calculate emissions on each roadway link, and a component that estimates emissions within grid squares.

The emissions module is a substantial part of the total computer program. In APRAC-1A, the emissions calculations were made from a simple equation that was incorporated with other parts of the calculations. Recently, the EPA has developed much more complex methods for estimating emissions (Kircher and Williams, 1975). The incorporation of these newer methods into the calculations has required extensive modifications to the computer program. Virtually nothing remains of the methods used to calculate emissions in the original model. Some of the simplifications that were formally employed to speed calculations have gone with the old methods. The revisions allow the emissions model to treat hydrocarbons (HC) and oxides of nitrogen (NO_x) as well as the carbon monoxide (CO) emissions for which it was originally designed. For TREES, a special modification was made to incorporate the emissions procedure for EPA's MOBILE-1 model.

The emissions module can be used by itself to provide gridded inventories of emissions based on traffic data. Such outputs by themselves are valuable representations of conditions in an area, or they can serve as inputs to models that use such gridded inventories. When the diffusion module is used, the gridded emissions and the emissions for each traffic link are both used in the calculations.

The emissions module has three major functions. They are

(1) To determine emissions on each primary traffic link.

(2) To determine the emissions from primary traffic links within each grid square.

(3) To determine the emissions from secondary traffic links within each grid square.

Primary traffic is considered to be all traffic that occurs on streets included in the input traffic data file. Secondary traffic is traffic that is on (generally) smaller streets, not included in the file.

The diffusion module has four major functions·

- Calculate diffusion.
- Provide the necessary meteorological information.
- Account for special-source conditions near the receptor.
- Organize and process the large files of traffic data.

The model provides certain options: Meteorological information can be processed to provide mixing depths, or the mixing depths can be read indirectly. Diffusion calculations can be made for as many as 625 locations for a single hour, as many as 10 locations for a single day, or for a year at a single location. Either airport or local wind inputs may be used.

The diffusion calculations use a number of area segments spaced at logrithmic upwind-range intervals from a receptor point, as shown in Figure C-7. These area segments are oriented to the direction of the transport wind and overlap the traffic network. The traffic links and portions of links falling within each area segment are identified, and the emissions from the individual links are accumulated to determine the average emission rate for each of the nine segments. Emissions are assumed to be released uniformly over the entire area of the segment.

A Gaussian-plume diffusion formulation is used for the calculations. The vertical concentration profile from a crosswind line source (such as a road) is assumed to be Gaussian in shape, as shown schematically in Figure C-8. The spread of this vertical concentration distribution is characterized by its standard deviation, σ_z.

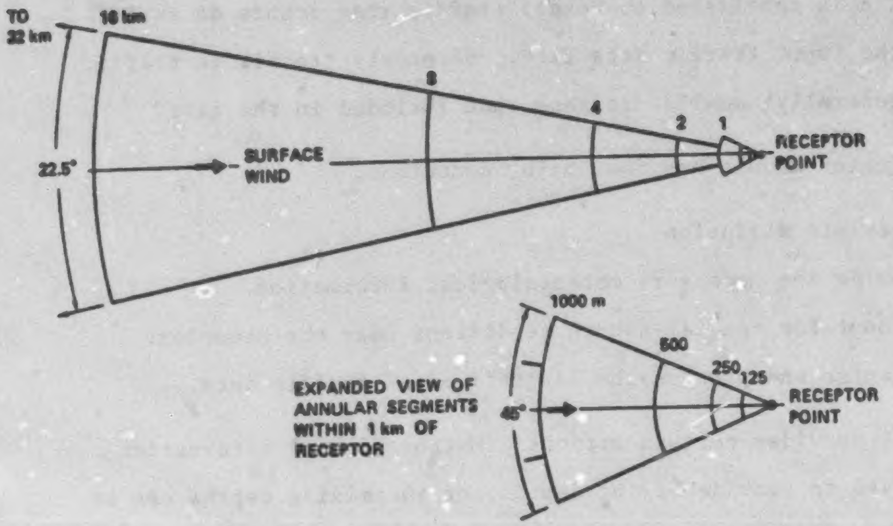


FIGURE C-7 DIAGRAM OF SEGMENTS USED FOR SPATIAL PARTITIONING OF EMISSIONS

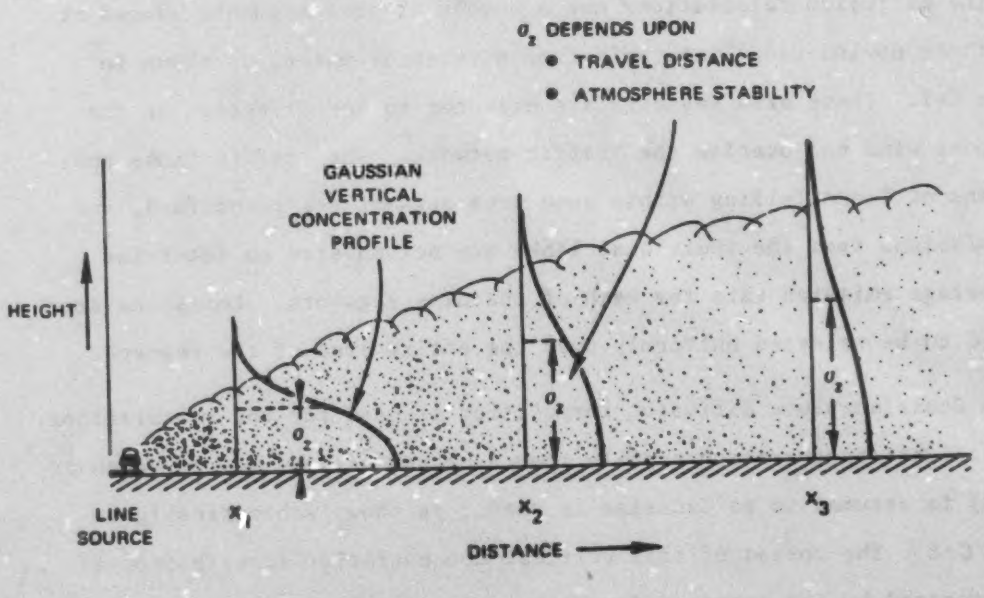


FIGURE C-8 VERTICAL DIFFUSION ACCORDING TO GAUSSIAN PLUME FORMATION

Validation Data Base

A detailed set of meteorological, traffic, and CO measurements collected in February 1978 by Mr. Norman Baker of CALTRANS (1978a) at the intersection of Highway 50 and Park Avenue in South Lake Tahoe provided an excellent data base with which to assess the accuracy of the microscale dispersion analyses. Other data were collected at the same time in Christmas Valley and Tahoe City. Figure C-9, C-10, and C-11 illustrate the location of the sites and the CO samplers while Table C-5 summarizes the CO data during the period.

CO calculations were made for the period 1800 PST, February 18, 1978 through 0100 PST, February 19, 1978 at the location of CALTRANS monitor 102 (see Figure C-9). Background concentrations were estimated from suitably sited monitors, and the resulting observations of local CO were compared with estimates from the indirect-source guidelines. The observed 8-hour average of 22ppm was exceeded by the 25-ppm estimate; the average absolute difference of the eight values was 4.2ppm, while the root-mean-square difference was 6.0ppm. The calculations were used subsequently (to evaluate future-year conditions) without calibration as this provided a conservative yet realistic estimate. However, the location of station 102 was too close to the intersection to provide a representative value with which to evaluate impacts, and so the hypothetical receptor was placed slightly more distant from the intersection: 24 ft (7.3 m) northwest of Highway 50 and 26.5 ft (8.1 m) southwest of Park Avenue.

Tables C-6 and C-7 summarize the traffic and meteorological input data for all sites and scenarios.

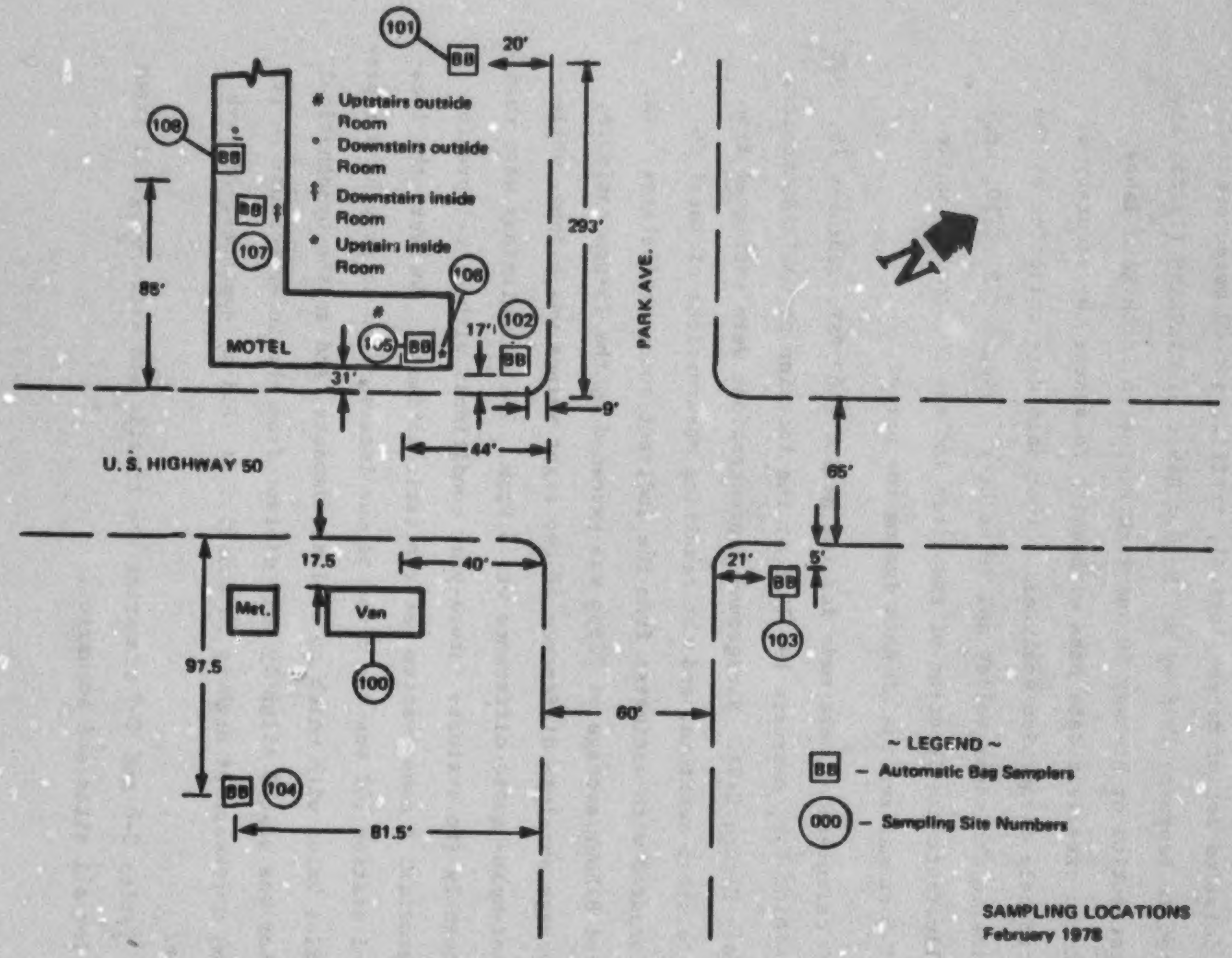


FIGURE C-9 MONITOR LOCATIONS IN SOUTH LAKE TAHOE

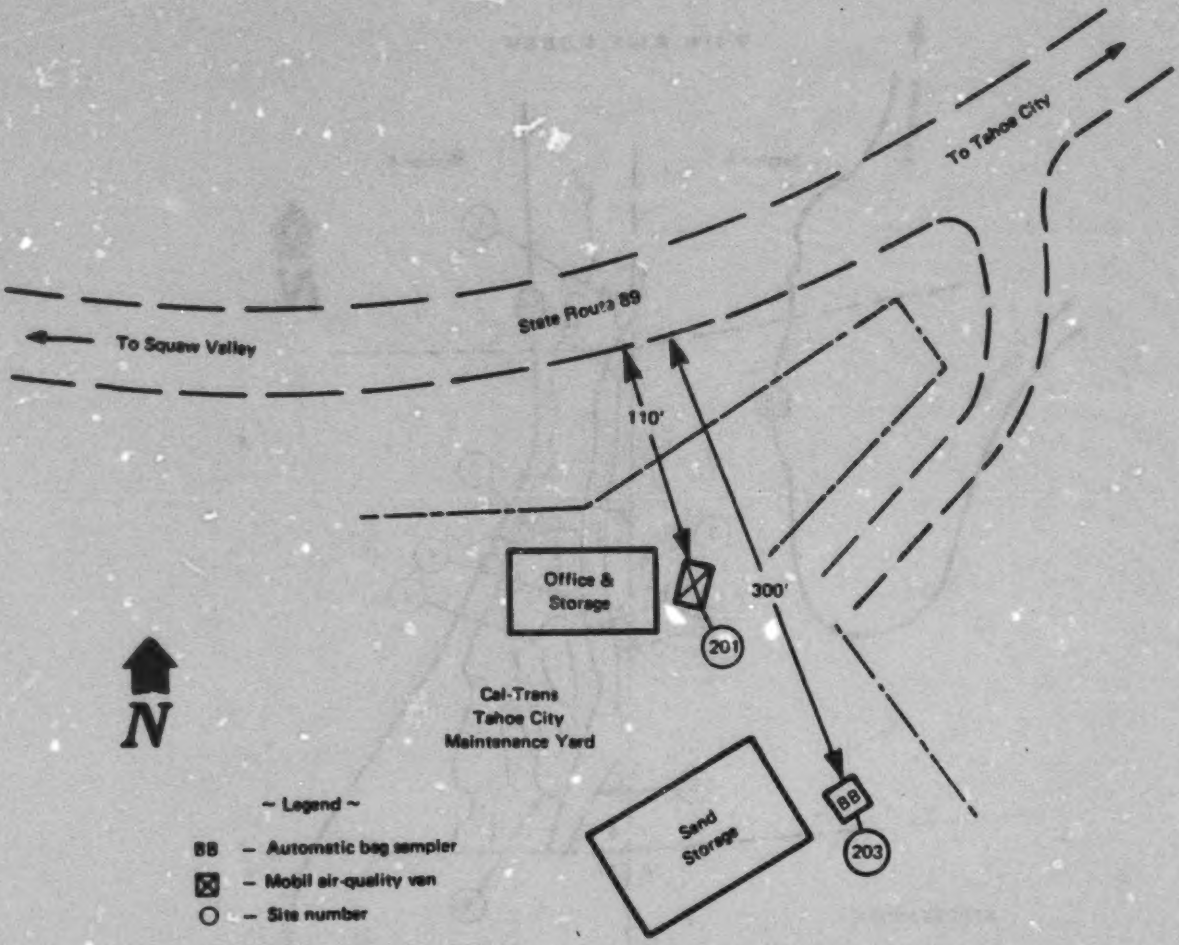


FIGURE C-10 MONITOR LOCATIONS IN TAHOE CITY

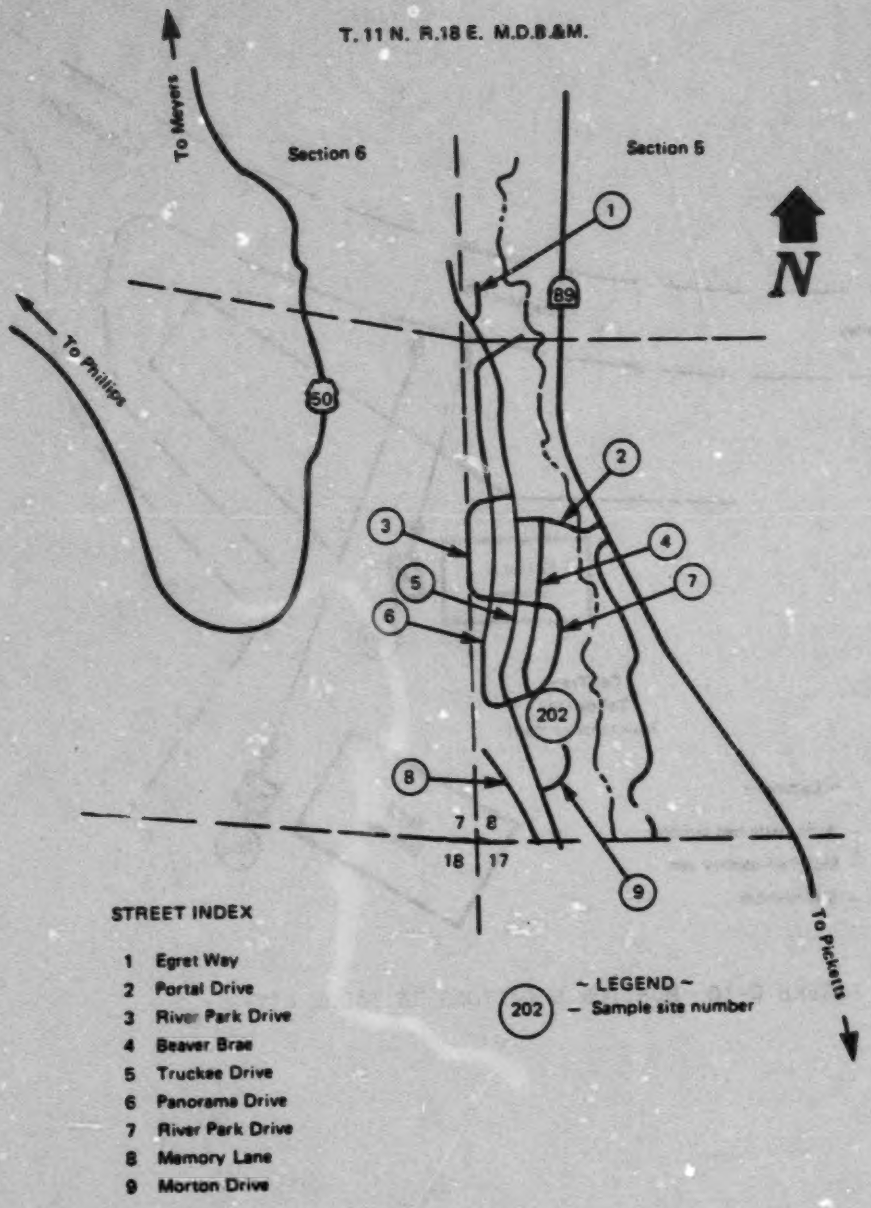


FIGURE C-11 MONITOR LOCATION IN CHRISTMAS VALLEY

Table C-5

CARBON MONOXIDE MONITORING SUMMARY FOR FEBRUARY 1978 CALTRANS STUDY

Site No.	Dates Sampled	Maximum 1-Hour Average Concentration	Date of Maximum 8-Hour Concentration	Maximum 8-Hour Average Concentration	Mean of Maximum 8-Hour Average Concentration (ppm)	Standard Deviation of Maximum 8-Hour Average Concentration	Highest 24-Hour Average Concentration (ppm)	Number of Violations of the Air-Quality Standards	
								8-Hour (6 ppm)	1-Hour (35 ppm)
100	9 Feb-25 Feb 78	27.5	14 Feb	18.0	11.7	3.16	11.0	33	0
101	9 Feb-26 Feb 78	23.0	20 Feb	9.0	8.0	1.27	7.0	10	0
102	9 Feb-26 Feb 78	39.0	19 Feb	30.5	15.2	5.9	19.0	30	2
103	9 Feb-26 Feb 78	32.0	19 Feb	23.9	14.3	3.5	17.0	36	0
104	9 Feb-26 Feb 78	8.0	19 Feb	6.8	6.7	0.18	5.0	2	0
105	9 Feb-26 Feb 78	28.0	19 Feb	20.3	10.8	3.61	13.0	27	0
106	9 Feb-26 Feb 78	18.0	18 Feb	16.5	9.8	2.43	11.0	24	0
107	10 Feb-14 Feb 78	12.0	11 Feb	10.0	10.0	0	6.0	1	0
108	10 Feb-14 Feb 78	11.0	13 Feb	8.3	8.3	0	5.6	1	0
201	11 Feb-23 Feb 78	6.0	18 Feb	3.8	--	--	2.4	0	0
202	24 Feb-27 Feb 78	2.0	26 Feb	1.3	--	--	--	0	0
203	17 Feb-22 Feb 78	5.0	19 Feb	3.8	--	--	2.6	0	0

Table C-6

TRAFFIC VOLUMES AND VEHICLE SPEEDS

1978 Hour (PST)	Traffic Volumes (Vehicles per hour)											
	Park Ave. & Highway 50				Tahoe "Y"		Crystal Bay		Tahoe City		Minden	
	Hwy 50 East	Hwy 50 West	Park Ave. North	Park Ave. South	Hwy 50 East	Hwy 50 West	Hwy 28 East	Hwy 28 West	Hwy 28 East	Hwy 28 West	Hwy 395 North	Hwy 395 South
1000*					1835	1660					150	150
1100					1966	1780	747	1032	993	880		
1200					2201	1991	838	1153	1111	985		
1300					2064	1868	784	1083	1042	924		
1400					2090	1892	794	1097	1055	936		
1500					2009	1817	763	1054	1014	899		
1600					1858	1682	706	975	938	832		
1700					2111	1911	802	1108	1066	945		
1800	1095	1063	453	302			556	768	739	655		
1900	1272	1091	496	331								
2000	1323	863	459	306								
2100	1179	903	437	292								
2200	1212	911	446	297								
2300	1013	1011	425	283								
2400	975	1074	430	287								
0100	634	929	328	219								
Vehicle Speed (mph)	10	10	20	25	5	5	5	15	10	10	35	35

* Beginning of hour

Table C-6 (continued)

	Traffic Volumes (Vehicles per hour)											
	Park Ave. & Highway 50				Tahoe "Y"		Crystal Bay		Tahoe City		Minden	
2000† Scenario	Hwy 50 East	Hwy 50 West	Park Ave. North	Park Ave. South	Hwy 50 East	Hwy 50 West	Hwy 28 East	Hwy 28 West	Hwy 28 East	Hwy 28 West	Hwy 395 North	Hwy 395 South
1	1425	1222	556	371	2111	1911	1155	1596	879	779	1920	1920
2	1654	1418	645	430	2449	2217						
3	1819	1560	709	473	2681	2427						
4	1730	1484	675	450	2554	2312						
5	1972	1691	769	513	2913	2637						
Vehicle Speed (mph)	5	5	15	20	5	5	5	15	10	10	30	30

†Peak-hour values

Table C-7

METEOROLOGICAL INPUTS

	Park Ave. & Highway 50			Tahoe "Y"			Crystal Bay			Tahoe City			Minden		
Hour (PST) 1978	Wind Speed (ms^{-1})	Wind Direction (degrees)	Stability	Wind Speed (ms^{-1})	Wind Direction (degrees)	Stability	Wind Speed (ms^{-1})	Wind Direction (degrees)	Stability	Wind Speed (ms^{-1})	Wind Direction (degrees)	Stability	Wind Speed (ms^{-1})	Wind Direction (degrees)	Stability
1000*				3.58	60	D							45	2.0	D
1100				4.11	24	D	4.11	204	D	4.11	200	D			
1200				3.66	28	D	3.66	208	D	3.66	160	D			
1300				2.32	17	D	2.32	197	D	2.32	135	D			
1400				2.41	18	D	2.41	198	D	2.41	145	D			
1500				2.86	17	D	2.86	197	D	2.86	125	D			
1600				2.64	14	D	2.64	194	D	2.64	135	D			
1700				1.97	47	D	1.97	227	D	1.97	180	D			
1800	1.97	79	D				1.97	259	E	1.97	230	E			
1900	1.30	123	E												
2000	1.25	132	E												
2100	1.21	134	E												
2200	1.21	119	E												
2300	1.25	126	E												
2400	1.16	117	E												
0100	1.21	126	E												
2000 Peak Hour Value	1.30	123	E	1.97	47	D	1.97	227	D	1.97	230	E	45	2.0	D

* Beginning of hour

OZONE

Method of Approach

The ozone isopleth plotting package (OZIPP), developed by Whitten and Hogo (1978) for the U.S. Environmental Protection Agency, was used to evaluate peak ozone concentrations within the Lake Tahoe Basin for each of the five scenarios. The standard OZIPP was not used because many of its inherent assumptions are not appropriate to the Basin. Rather, the model was modified and many of the inputs tailored on the basis of local measurements and conditions; changes were made in the following areas:

- The photolytic rate constants in OZIPP were changed to reflect the altitude of the Basin (ca. 1850m).
- Temporal and spatial variations in emission rates of hydrocarbons and oxides of nitrogen (NO_x) for the base year (1978) were computed using the APRAC-2 model for input to OZIPP.
- Inversion heights were based on temperature profiles measured in the Basin by the California Air Resources Board (Unger, 1978) during the summer of 1978.
- The ratio of early morning concentrations of nitrogen dioxide and total oxides of nitrogen were based on CARB summer measurements in the Basin.
- Vertical and horizontal ozone transport was estimated on the basis of the numerous measurements made last summer by CARB between Sacramento and Lake Tahoe.
- The "design day" was further characterized by initial, early morning August 1978 measurements of non-methane hydrocarbon and NO_x concentrations in the Stateline (south shore) area.

Descriptions of OZIPP and the source of the input data are given in the following sections.

The Ozone Isopleth Plotting Package (OZIPP)

OZIPP forms the basis of an empirical kinetic modeling approach called EKMA that provides a procedure for relating photochemical oxidants (expressed as ozone) to organic compounds and oxides of nitrogen. The EKMA utilizes a set of ozone isopleths (lines of equal concentration) which depict maximum afternoon concentrations of ozone downwind from a city as a function of the following parameters:

- Morning concentrations of non-methane hydrocarbons (NMHC) and oxides of nitrogen (NO_x)
- Emissions of NMHC and NO_x occurring during the day
- Meteorological conditions
- Reactivity of the NMHC mix
- Concentrations of ozone and precursors transported from upwind areas.

The isopleths are constructed by OZIPP which performs computer simulations of atmospheric photochemical reactions with various assumed levels of initial NMHC and NO_x concentrations. The ozone isopleths are then plotted as a function of initial precursor concentrations.

EKMA is a technique for relating changes in the maximum one-hour average ozone concentrations observed within or downwind of an urban area to changes in the ambient concentrations of NMHC and NO_x in that urban area. It is intended primarily for estimating the emissions controls required in urban areas as part of the State Implementation Plans (SIP) to meet national ambient air quality standards. Thus, EKMA is used to address questions such as:

- What percentage reduction in the ambient concentration of NMHC or NO_x, or both, would be needed to attain compliance with the federal air quality standard for photochemical oxidants (ozone)?

- What reduction in the maximum one-hour average ozone concentration is likely to accompany a given reduction in the ambient concentration of NMHC or NO_x?

Procedures for applying the EKMA technique are described elsewhere (EPA, 1977). This reference also discusses the derivation of the information which is used in OZIPP.

The primary function of OZIPP is to generate ozone isopleth diagrams that are representative of conditions in a particular city. These types of diagrams, termed city-specific diagrams, are generated by OZIPP using city-specific information on the location and time of year (thereby defining sunlight intensity), local atmospheric dilution rate and local diurnal patterns of NMHC and NO_x emissions.

OZIPP consists of two distinct parts. The first part, a kinetics model, mathematically simulates the physical and chemical processes taking place in the atmopshere. The second part, the ozone isopleth plotting package, uses the simulation results to construct an ozone isopleth diagram. The physical model underlying the kinetics model in OZIPP is similar in concept to a trajectory-type photochemical model. In the kinetics model, a column of air transported along an assumed trajectory is modeled. The column is assumed to extend from the earth's surface to the base of a temperature inversion. The horizontal dimensions of this column are such that the concentration gradients are small. This makes it unnecessary to consider horizontal exchange of air between the column and its surroundings. The air within the column is assumed to be uniformly mixed at all times.

At the beginning of a simulation, the column is assumed to contain some specified initial concentrations of NMHC and NO_x due to prior emissions. The column may also contain NMHC and NO_x that were transported with the column from areas upwind of the city being considered.

As the column moves along the assumed trajectory, the height of the column can change because of temporal and spatial variations in mixing height. The height of the column is assumed to change exponentially with time during a user selected period, and to be constant before and after that period. As the height of the column increases, its volume increases, and air above the inversion layer is mixed in. Any ozone or ozone precursors from the inversion layer that are mixed into the column as it expands are assumed to be immediately mixed uniformly throughout the column.

The kinetics model in OZIPP can also consider emissions of NMHC and NO_x into the column as it moves along its trajectory. The concentrations of the species within the column are physically decreased by dilution due to the inversion rise, and physically increased by entrainment of pollutants transported aloft and by fresh emissions. All species react chemically according to a kinetic mechanism that includes 76 chemical reactions. Certain photolysis rates within that mechanism are functions of the intensity and spectral distribution of sunlight, and they vary diurnally according to time of year and location. These have been modified to reflect the high elevation of the Lake Tahoe Basin.

The assumptions and specifications that describe the kinetics model are:

- The air mass of interest is an imaginary air parcel (column) of fixed horizontal area at a constant temperature, within which pollutants are well mixed.
- There is sufficient homogeneity that horizontal diffusion does not affect pollutant concentrations within the column.
- The height of the column varies exponentially with time during a specified period and is constant at other times (an exponential

variation is equivalent to a constant percentage dilution per unit time).

- The column contains specified initial concentrations of NMHC and NO_x due to emissions prior to the simulation starting time within the urban area of interest. The NMHC is assumed to be 25 percent propylene and 75 percent n-butane, unless changed by the user. Five percent of the initial NMHC concentration is added as aldehydes, unless changed by the user.

- Pollutants transported within the surface layer from outside the urban area of interest (sometimes called background) may be present in the column at the start of each simulation (0800 LDT). The pollutant concentrations due to transport in the surface layer are normally assumed to be zero, but the user may specify other values for the NMHC, NO_x and ozone concentrations transported within this layer. The NMHC transported within the surface layer is assumed to be 10 percent propylene and 90 percent butane (as carbon). The NO_x transported in the surface layer is assumed to be 100 percent NO_2.

- The initial concentrations in the column are thus the sum of the contributions from emissions occurring prior to 0800 LDT plus concentrations transported in the surface layer from upwind locations. Emitted species include propylene, n-butane, NO, NO_2, acetaldehyde and formaldehyde. Transported species include propylene, n-butane, NO_2 and ozone.

- The changes in pollutant concentrations within the column are calculated, by computer simulation, from 0800 to 1800 LDT.

- Entrainment of pollutants transported aloft is possible during the rise of the inversion layer. OZIPP only permits entrainment of constant concentrations of NMHC, NO_x and ozone. NMHC in pollutants transported aloft is assumed to be 10 percent propylene and 90 percent n-butane (as carbon). No acetaldehyde or formaldehyde is added. NO_x transported aloft is assumed to be 100 percent NO_2.

- Pollutants emitted into the column after 0800 LDT can be represented by specifying additions of NMHC and NO_x each hour. The assumptions about the propylene/n-butane and the aldehyde additions are the same as for the initial condition assumptions.

The fraction of NO_x that is NO_2, however, is 10 percent for post-0800 emissions.

- Zero cloud cover is assumed.

Input Data

Horizontal Ozone Transport

High ozone concentrations in the Basin had been speculated to be the result of horizontal transport from the Sacramento area. To evaluate this possibility, CARB established a network of ozone monitors that incorporated stations in the following location: Sacramento, Folsom, Placerville, Sky Park, Loon Lake, Kyburz, Strawberry, South Lake Tahoe, and Incline. The measurements do not support the contention that horizontal transport from Sacramento is a major cause of high-ozone levels in Lake Tahoe. Two August days with both very high ozone (12 and 18 pphm) in Sacramento and moderately high ozone (8 pphm) in the Basin are represented in Figures C-12 and C-13. These time-distance cross-sections indicate some eastward ozone transport occurs, but that it is primarily restricted to an area that is bounded by Sky Park or Kyburz. The ozone patterns east of Kyburz are apparently unrelated to conditions further west. As a consequence, a minimal amount of ozone (2 pphm) was considered to be transported horizontally into the Basin. The observations also suggest a natural, persistent ozone background in excess of 3 pphm throughout the region.

The possibility of downward transport of stratospheric ozone in the Lake Tahoe Basin is suggested from various data analyses. Unger (1978) reported that an apparent case occurred in June 1976. From data collected by the California ARB, high oxidant concentrations during the winter and at night were noted. These occurrences are unexpected because of the lack of sufficent solar energy to form photochemical oxidants.

On the night of August 12, 1978, a rapid increase of ozone concentrations from 5 pphm to 9 pphm between 2 a.m. (PDT) and 7 a.m. was recorded by CALTRANS in Tahoe City. During four other days of the same month, a signi-

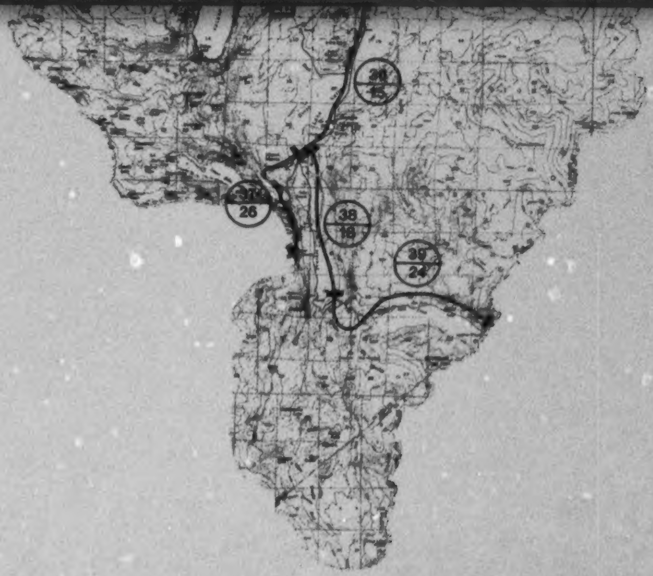


Figure C-15 UPDATE OF VISUAL CONDITIONS LAKE TAHOE BASIN

ROADWAY UNIT

ROADWAY UNIT WITH SIGNIFICANT CHANGE

ROADWAY UNIT NUMBER
VIEW RATING 1972
VIEW RATING UPDATE

Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency
Sedway/Cooke

0 1 2 4 miles north

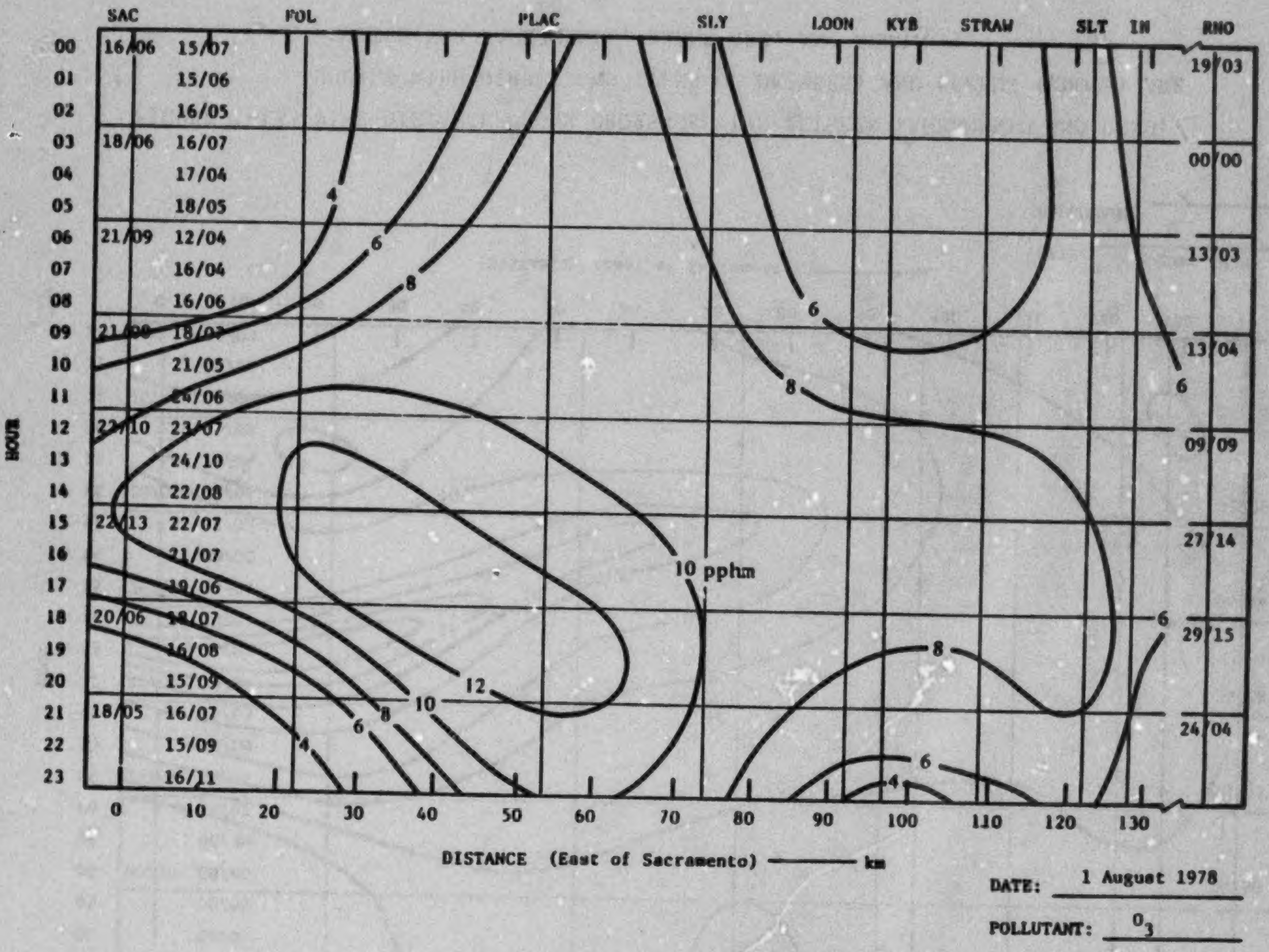


FIGURE C-12 TIME-DISTANCE OZONE CROSS-SECTION BETWEEN SACRAMENTO AND RENO; HOURLY WIND DIRECTIONS (TENS OF DEGREES) AND SPEEDS (KNOTS) ARE PLOTTED FOR SACRAMENTO, BEALE AFB, AND RENO.

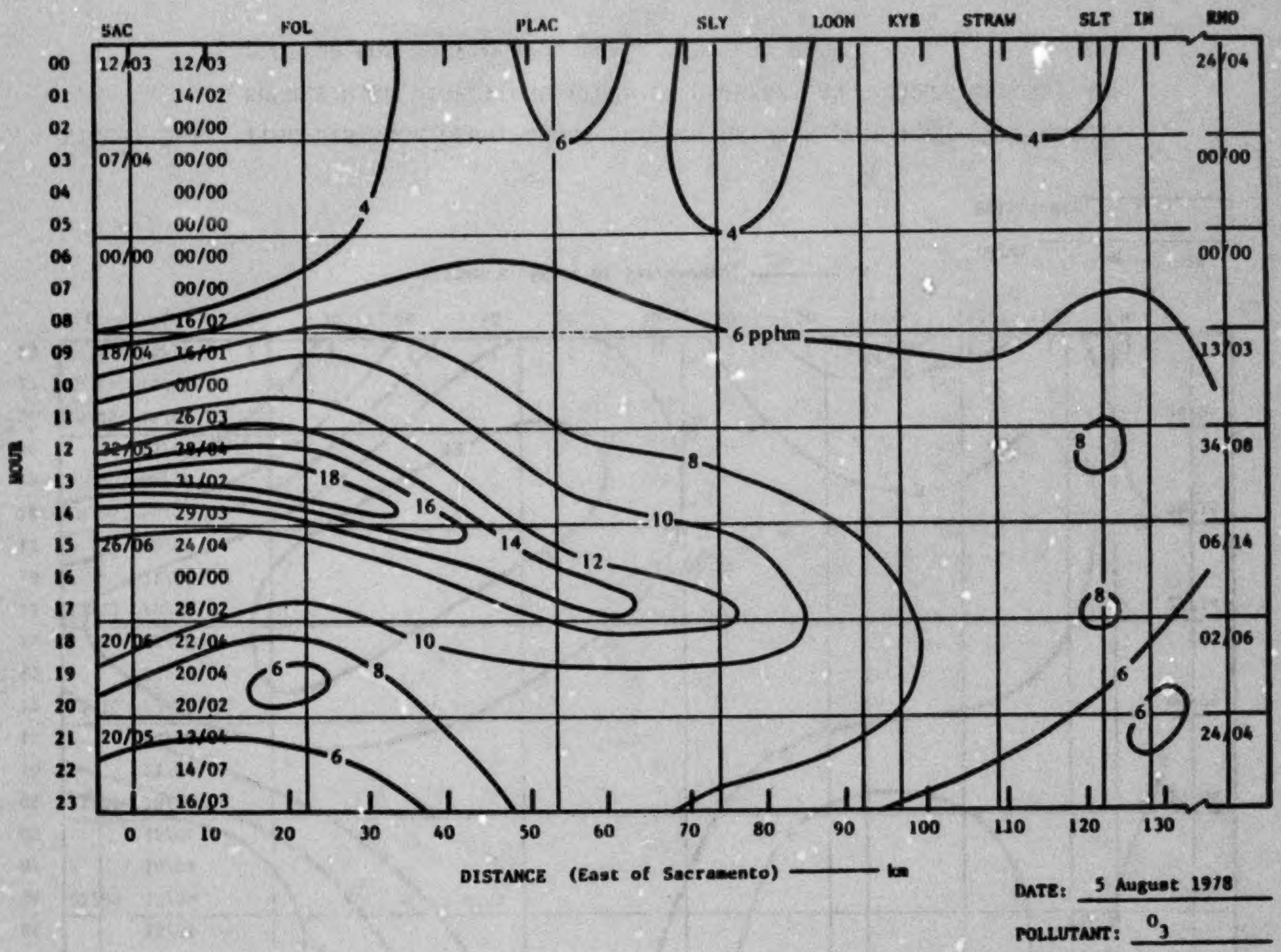


FIGURE C-13 TIME-DISTANCE OZONE CROSS-SECTION BETWEEN SACRAMENTO AND RENO; HOURLY WIND DIRECTIONS (TENS OF DEGREES) AND SPEEDS (KNOTS) ARE PLOTTED FOR SACRAMENTO, BEALE AFB, AND RENO.

Table C-8

OZIPP INPUT DATA

```
OZONE ISOPLETH DIAGRAM FOR LAKE TAHOE (AUGUST 1 EMISSIONS/METEOROLOGY)

PHOTOLYTIC RATE CONSTANTS CALCULATED FOR

        LAKE TAHOE

LATITUDE      39.000
LONGITUDE     120.000
TIME ZONE     8.0
DATE          8    1    1978
TIME          800  TO   1800     LOCAL DAYLIGHT TIME
SOLAR NOON    1306

DILUTION DETERMINED FROM THE FOLLOWING
INVERSION HEIGHTS      INITIAL    945.     FINAL      3850.
TIMING                 START      800.     STOP       1330.

INITIAL PROPYLENE FRACTION       .250      NO2/NOX     .560
INITIAL ALDEHYDE FRACTION        .050

TRANSPORTED CONCENTRATIONS
SURFACE LAYER          OZONE     .020     HYDROCARBON  0.000     NOX  0.000 PPM
ALOFT                  OZONE     .050     HYDROCARBON  0.000     NOX  0.000 PPM

CONTINUOUS EMISSIONS (EXPRESSED AS THE FRACTION OF
INITIAL NON-BACKGROUND CONCENTRATION EMITTED PER HOUR)
HOUR         1      2      3      4      5
FRACTION   .280   .270   .240   .420   .210
```

ficant increase in ozone concentrations occurred within 2 hours after sunrise. These data suggest the mixing of elevated ozone down to the surface in support of the theory of stratosperhic ozone intrusion into the Lake Tahoe Basin.

Ozone Predictions

Table C-8 summarizes the input data used in the OZIPP calculations for the 1978 design day. These data correspond to actual worst-case conditions observed on August 1, 1978, in the Basin. Emissions were calculated in the following manner:

- Wind trajectories were calculated for the Basin, originating at 0800 PDT in the Stateline area.
- APRAC-2 was used to calculate hourly gridded emissions of hydrocarbons and oxides of nitrogen.
- Emissions along the trajectory were compared to the early morning emissions at the trajectory origin, and hourly emissions ratios were then determined.

Two sets of ozone predictions were made: one used initial nonmethane hydrocarbon (MNHC) and NO_x concentrations appropriate to August 1, 1978, conditions, while the second was appropriate to initial values observed on August 5, 1978. These design values are summarized below, together with the design value for ozone (as calculated)

Design Values	August 1	August 5
NMHC (ppm)	0.17	0.22
NO_x (ppm)	0.05	0.08
O_3 (pphm)	9.6	11.5

Figure C-14 illustrates the Tahoe-specific ozone isopleth diagram along with both sets of design values and their corresponding ozone predictions. Five predictions are shown; one of each scenario. As illustrated, ozone concentrations are expected to decrease substantially, being less than the old ambient standard of 8 pphm in all cases.

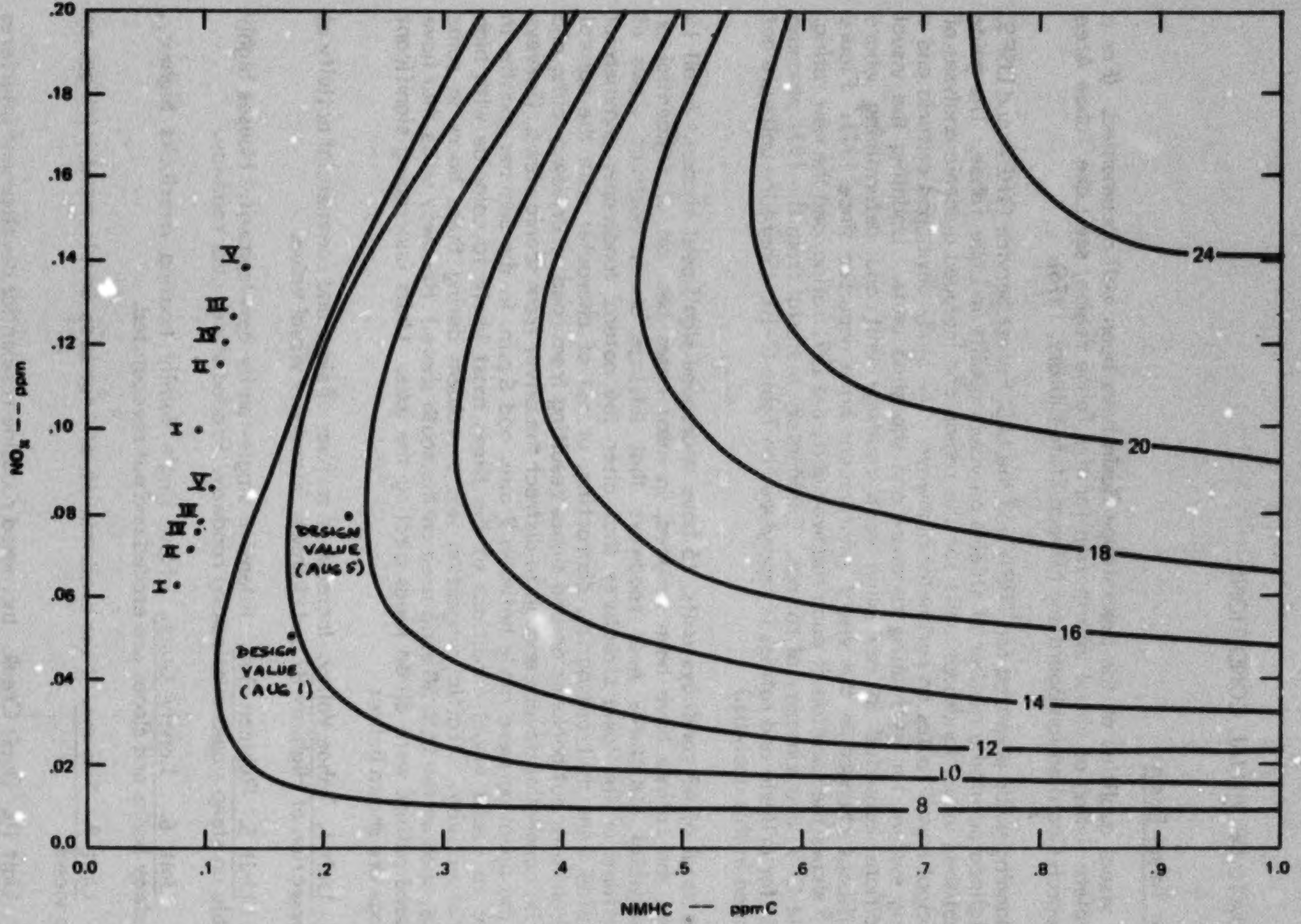


FIGURE C-14 TAHOE-SPECIFIC OZONE ISOPLETH DIAGRAM, TOGETHER WITH DESIGN VALUES AND OZONE PREDICTIONS FOR FIVE SCENARIOS.

4. VISUAL RESOURCES

UPDATE OF VISUAL CONDITIONS

Lake Tahoe Basin

The visual qualities of the Lake Tahoe Basin have been well documented. (For a complete listing of visual information for the Tahoe region, see Lake Tahoe Area Research Coordination Board and Nevada State Library, 1976).

A planning guide prepared for TRPA and the U.S. Forest Service (TRPA and USFS, 1971g) incorporated a number of studies on visual quality in Lake Tahoe. The guide established visual landscape units for the region and included a scenic analyses of principal travel routes on perimeter highways. The study developed criteria and a rating system for evaluating roadway and shoreline units. Updating the visual conditions consisted in reviewing each roadway unit and determining where significant changes in the visual environment have occurred since 1971. Figure C-15 shows the location of each roadway unit, the 1971 rating, and the new rating. Table C-9 is a summary of ratings. Explanatory material from the 1971 planning guide for criteria and ratings is reproduced on Table C-10. (Shoreline units are not updated in this analysis.)

Of a total of 43 roadways units, 15 have undergone significant change. In all 15 cases, the ratings have been reduced, in most cases because of residential or commercial structures near roadways that infringe on or obstruct views of mountains or the lake; structures that alter the natural landscape; commercial roadside signs that are garish, distracting, or out of character with the natural environment; cut banks or eroded slopes resulting from road or driveway cuts; and traffic congestion severe enough to distract the driver from scenic views. (Surveys for the updating were made between 9 a.m. and 6 p.m. in the summer months in order to assess visual conditions at the times most likely to coincide with high tourist activity. Traffic congestion was a problem during these hours in some areas, such as the U.S. 50 strip area on the south shore.) Roadway units that have reduced ratings were all on roads circling the lake. Units undergoing significant change are shown below:

Unit 1. Tahoe Valley. Increase in number of signs and commercial activity at intersection of Highway 89 and Highway 50 reduces visual value.

Unit 5. Rubicon Bay. Intensive single-family development. Houses highly visible on steep slopes overlooking roadway. Eroded slopes near roadway.

Unit 6. Lonely Gulch. New single family housing overlooks highway. Roadway banks and slopes are eroded and not revegetated.

Unit 9. Tahoma. New condominium and roadside development infringes on lake views.

Unit 10. Quail Creek. Increased roadside residential development interferes with nearby lake views and creates suburban atmosphere.

Unit 14. Tahoe Tavern. New roadside commercial uses and signs intrude on forested roadside.

Unit 16. Lake Forest. New condominium and resort development alters natural landscape.

Unit 17. Cedar Flat. Some new single family development near roadside causes eroded cut banks and minor visual changes.

Unit 18. Carnelian Bay. Some new roadside signs and new commercial uses slightly increase roadside distraction.

Unit 20. Tahoe Vista. Traffic congestion, roadside signs, and new lakeside development increase distractions and block views of lake and mountains.

Unit 22. Crystal Bay. Highrise apartment development on lakeside interferes with magnificant lake views. Incline Village commercial area well-designed, but unrevegetated cut banks and roadside signs distract from otherwise pleasant views.

Unit 31. Meadow. North end of this unit has been changed by new commercial center at Round Hill, which is unobtrusively set back from road; the roadside, however, is infringed upon by service stations and large signs. Meadow setting at south end of unit still functions as effective foreground contrast to casinos.

Unit 32. Casino Area. New housing, trailer camps, and casinos impose on visual quality of landscape, producing clutter rather than variety. Construction sites detract from roadside areas. Views out toward mountain backdrops obscured by new high rise buildings.

Unit 33. The Strip. The Strip in this area has become so densely infilled that almost no views outward to lake or to mountain backdrop are available. Commercial infilling and new roadside signs in garish colors reduce visual quality. Traffic congestion has a serious adverse impact on visual quality and safety.

Unit 35. Al Tahoe. Traffic congestion and roadside parking make this area extremely distracting and even dangerous. Infill of commercial uses and number and height of road signs increase distractions.

Roadway in the south shore area were divided into visual units and mapped as part of a study of visual conditions prepared for TRPA in 1972 (TRPA, 1972d). Visual conditions along roadway corridors of the south shore area, designated as visual unit 9 (south Tahoe-Stateline south), are shown in Figure C-16. Areas of major change that have occurred since the original study are indicated by brackets. Changes are due primarily to new single-family residential development, infilling along commercial strips, new highrise buildings, new residential development along roadways, and removal of roadside vegetation screens.

Pioneer Trail. New scattered single-family residential development occurs in three locations. The Montgomery Estates and Bohannon residential developments have significantly changed the aspect of the Cold Creek-Lake Christopher area. (Removal of roadside vegetation screens and eroded cut banks are associated with

TABLE C- 9
UPDATED RATING SUMMARY - ROADS

Unit No.	Unit Name	Criteria Old/New						Total Old/New
		1	2	3	4	5	6	
1	Tahoe Valley	3/2	3/2	5/2	1/2	1/2	3/1	14/11
5	Rubicon Bay	4/2	4/3	4/1	4/4	4/4	3/3	23/17
6	Lonely Gulch	3/2	4/3	4/2	4/4	4/4	2/2	21/17
9	Tahoma	2/2	3/2	3/3	2/1	3/3	2/2	15/13
10	Quail Creek	4/2	3/2	3/3	3/2	2/2	3/3	18/14
14	Tahoe Tavern	3/2	3/2	4/4	2/2	2/2	3/3	17/15
16	Lake Forest	3/1	3/2	4/4	3/3	3/3	2/2	18/15
17	Cedar Flat	3/2	2/2	3/3	4/4	3/3	3/3	18/17
18	Carnelian Bay	1/1	3/1	3/3	4/4	3/3	2/2	16/14
20	Tahoe Vista	1/1	1/1	3/1	3/3	4/3	2/2	14/11
22	Crystal Bay	4/2	3/2	3/2	3/2	4/3	4/4	21/15
31	Meadow	3/1	4/2	3/3	3/3	1/1	4/4	18/14
32	Casino Area	4/2	1/1	2/1	2/2	2/1	4/3	15/10
33	The Strip	1/1	1/1	2/1	2/1	2/1	1/1	9/6
35	Al Tahoe	1/1	2/1	2/1	2/1	1/1	2/1	10/6

residential development.) Commercial development, primarily motels and apartments, has extended south from the junction of Pioneer Trail and U.S. 50.

U.S. 50 Strip. Commercial infilling and larger parking lots adjacent to the roadway have reduced visual variety and, in some instances, have blocked views. The number of commercial signs has increased. Three sections of U.S. 50 have been subject to heavy commercial infilling: the section from the junction of U.S. 50 and Highway 89 to the Truckee River; the Al Tahoe section from the Truckee River to Trout Creek; and the Bijou Park section from Bijou Golf Course to Ski Run Boulevard.

The Park Tahoe highrise casino is now an imposing vertical element in the landscape at Stateline and obstructs views of the mountains beyond.

Casino construction and new commercial development at the junction of Kingsbury Grade and U.S. 50 junction have weakened the previously well-defined boundary between the urban Stateline area and the open landscape to the north. Kingsbury Grade from the U.S. 50 junction to the national forest boundary has been the site of extensive new low-rise commercial development and scattered single family houses. Banks have eroded, and vegetation has been removed along this section.

Commercial development along U.S. 50 below the intersection with Highway 89 (the "Y") has increased somewhat.

Highway 89. Commercial uses and signing along the section of Highway 89 in the city of South Lake Tahoe have increased, and vacation of single-family homes have been converted to tourist accommodations. This section of road still has heavy roadside vegetation.

A primary objective of the law that created TRPA (PL 91–148) was to preserve the natural beauty of the lake and its surroundings. However, efforts to improve the environmental quality of the basin in recent years have not had much effect on the visual environment. Solutions to problems of visual deterioration, it appears, are not necessarily related to solutions to ecological problems. Exporting sewage out of the basin, for example, has improved water quality in the basin, but has only indirectly and temporarily affected visual quality through recent limitations on the number of dwelling units that can be built.

TABLE C-10
CRITERIA AND RATINGS[1]

RATING SHEET-ROADS

Number	Criteria	Rating
1. a.	Manmade features detract from the natural landscape scene.	1
b.	Manmade features cause only temporary distractions.	3
c.	Manmade features do not detract from the natural landscape	5
2. a.	Physical distractions interfer with enjoyment of the drive.	1
b.	Physical distractions cause some interference with enjoyment of the drive.	3
c.	Physical distractions do not interfere with enjoyment of the drive.	5
3. a.	Road detracts from the natural scene because of alignment, cuts, fills, etc.	1
b.	Road causes some detraction from the natural scene.	3
c.	Road enhances the visual experience.	5
4. a.	Travel zone is frustrating because it does not offer views of the lake.	1
b.	Travel zone offer glimpses of the lake.	3
c.	Travel zone offers a variety of views of the lake.	5
5. a.	Travel zone gives no opportunity to view natural landscape expanses.	1
b.	Travel zone gives only limited opportunity to view natural landscape expanses.	3
c.	Travel zone given many opportunities to view natural landscape expanses.	5
6. a.	Travel zone is monotonous.	1
b.	Travel zone has some variety.	3
c.	Travel zone has much variety.	5

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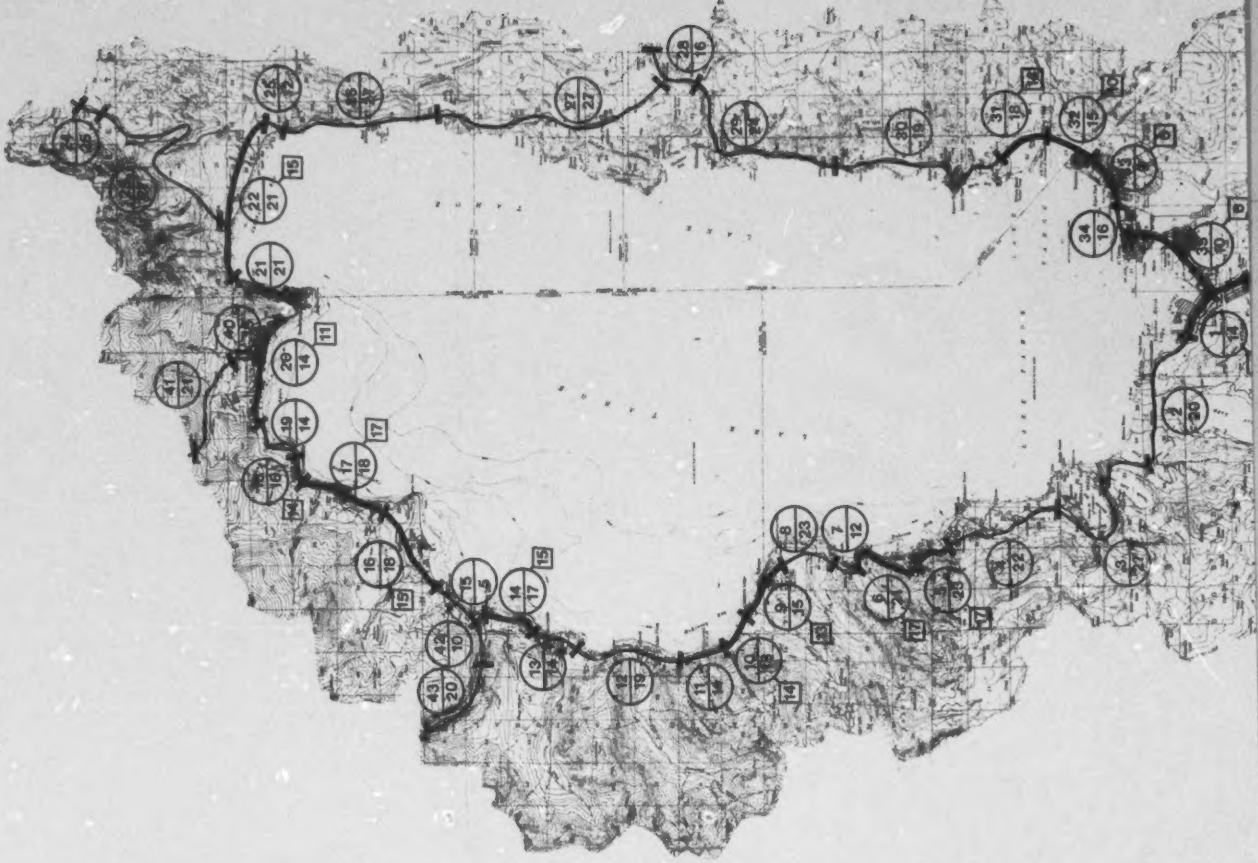
[1] Critera and ratings above are those used by the special U.S. Forest Service Task Group in rating views from the roadway for the Scenic Analyses of Principal Travel Routes, USFS/TRPA, 1971.



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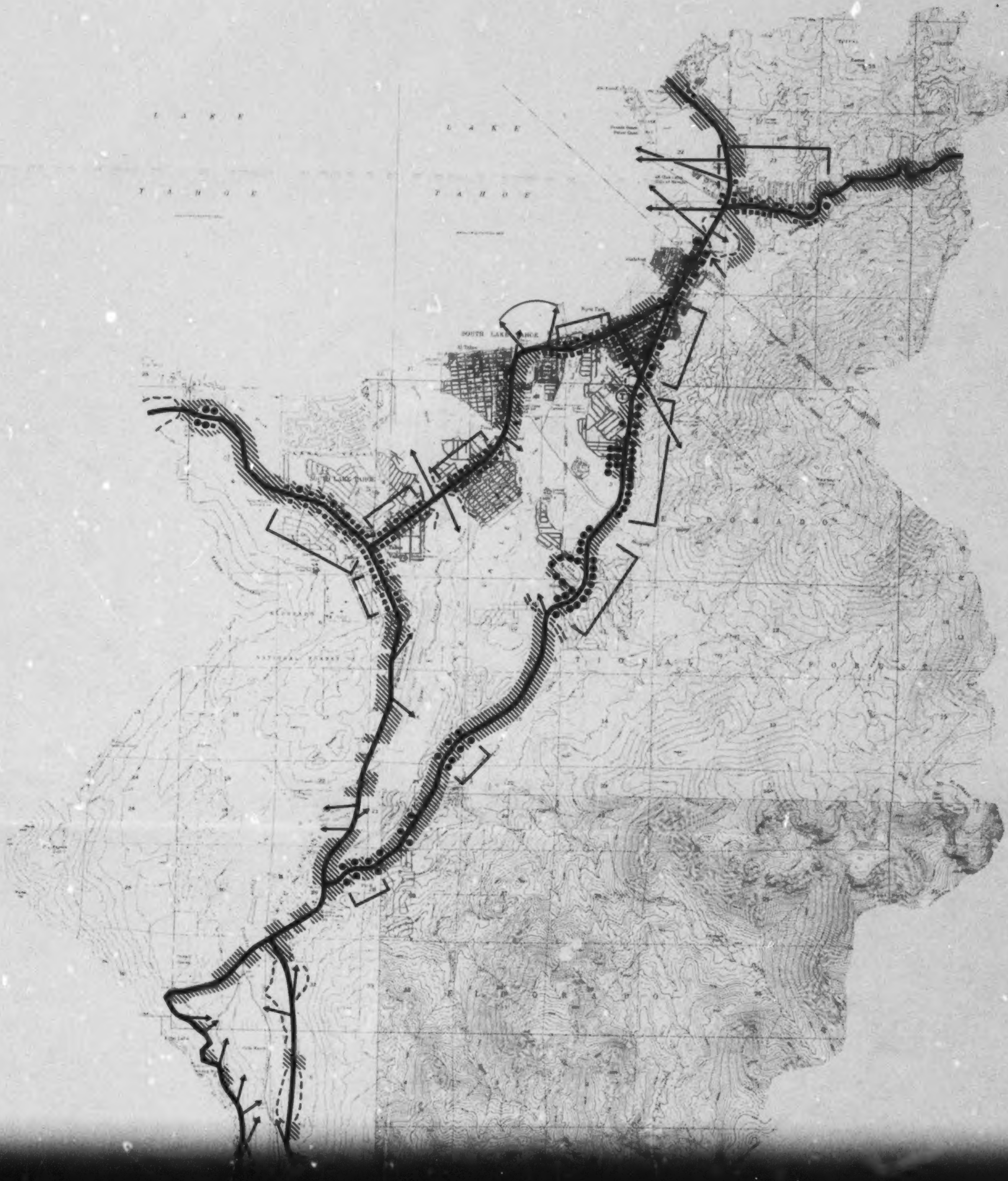
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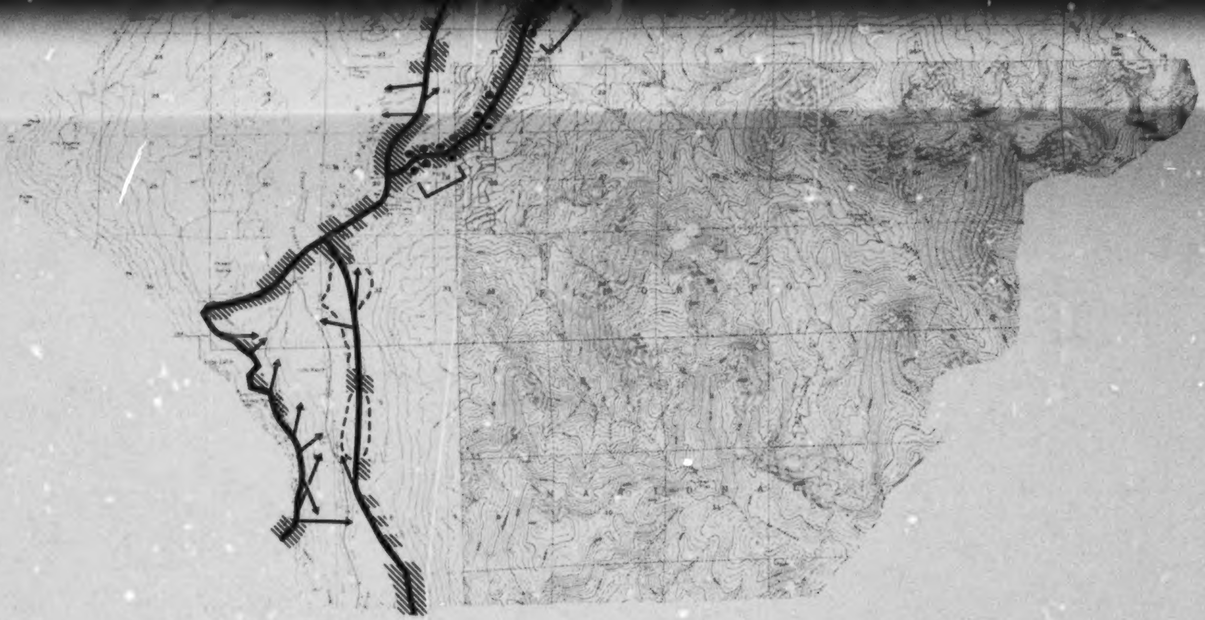


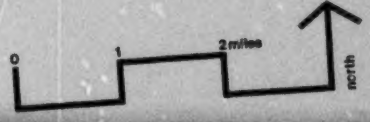
Figure C-16 1978 UPDATE OF VISUAL CONDITIONS SOUTH LAKE TAHOE

▨	FOREST ROADSIDE VEGETATION
→	VIEWS
⬭	CLEARING
•	RESIDENTIAL DEVELOPMENT
	COMMERCIAL DEVELOPMENT
·	LOWRISE · INCLUDES PARKING LOTS
▪	HIGHRISE
○	TRAILER PARK
⊔	AREAS OF SIGNIFICANT VISUAL CHANGE

Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency

Cooke



D. EXISTING SOCIAL ENVIRONMENT IN LAKE TAHOE HYDROGRAPHIC BASIN

1. LAND USE

LANDOWNERSHIP PATTERNS

Public Landownership

On the California side, public ownership in the Eldorado National Forest is relatively solid. In the Tahoe National Forest, large sections still in private ownership are interspersed with national forest lands. Private lands of varying sizes are scattered throughout the Toiyabe National Forest on the Nevada side. State holdings, though smaller in size, are contiguous, and all have some shoreline acreages.

Public ownership of shorezone lands in the Lake Tahoe Basin is limited. Thus, although the central attraction in the basin is the lake itself, unless the visitor is familiar with the area, he must confine himself to major roads encircling the lake. Although much land in the basin is publicly owned, most land visible to the average visitor is privately owned, and public facilities easily accessible or visible from major roads (such as U.S. Forest Service or state campgrounds) are often full and require reservations. Consequently, the visitor comes away with the impression that the area is given to residential and commercial uses that are either inaccessible or costly.

Because so much prime land in the basin seems off limits and because of environmental degradation caused by development, a number of attempts have been made to place the entire basin in public ownership. As early as the 1930s, the federal government assessed the feasibility of declaring the basin a national park, but the large amount of land in private ownership even then precluded such an action (Bronson, 1971). Since that time, a number of proposals have been made to place the basin in public ownership. In 1970 Congress authorized the Secretary of the Interior to study "the feasibility and desirability of creating a national lakeshore at Lake Tahoe" (Public Law 91-425). The report (U.S. Department of Interior, Bureau of Outdoor Recreation, 1971) recommended that a national lakeshore be established to be administered by the U.S. Forest Service and that a substantial land acquisition program be implemented. Because of local opposition and high costs, the recommendations of the study were not carried out by the Department of the Interior.

In 1977 the California State Resources Agency proposed that Congress declare Lake Tahoe a national scenic area (NSA), in which both public and private lands would be managed by the federal government, probably through the U.S. Forest Service (Johnson, 1977). This proposal is supported by a number of public interest groups, and the League to Save Lake Tahoe has drafted legislation to establish the NSA.

Private Landownership

Privately owned land is concentrated in three areas: 1) adjacent to the lake; 2) in relatively flat "valleys", such as the South Lake Tahoe/Meyers area on the south shore and the Incline Village and Tahoe City areas on the north shore; and 3) along major roadways, including the Kingsbury Grade section of Highway 28. One major exception to this pattern is the checkerboard of private and public ownership in the Tahoe National

Forest, which extends from the west shore of the lake to the western basin boundary. Here large parcels (ranging from one to several square miles) in single ownership alternate with Tahoe National Forest land. The U.S. Forest Service has plans to acquire most of the privately held land in large parcels in the Tahoe National Forest within the year. A few smaller, individually owned parcels are scattered throughout this area, especially in Ward Valley. These parcels will not be acquired in the immediate future. (Stoms, pers. comm.)

Shorezone and beach front land in both California and Nevada tends to be in small, individually owned parcels of developed properties. Private holdings on the Nevada side of the basin are generally not large, and most of the privately owned land is developed.

The pattern of privately owned lands coincides with the pattern of urbanization.

EXISTING LAND USE

Total acreage of privately owned lands in the Lake Tahoe Basin is 63,730. Of these acres, 65 percent are in California and 35 percent are in Nevada. A total of 24,000 acres (about 40 percent) are either developed or subdivided for development and require only permits for construction. Most subdivided acres are in the low-density residential land use district. Table D-1 shows land area in land use districts and available land remaining in 1978 and under the five growth scenarios.

Within the STPUD service area, there are 11,297 subdivided but undeveloped lots. Most of these lots are within the low-density residential land use district, and most have been assessed for sewer service by STPUD, even though they are not now connected.

Land use in the Douglas County Sewer Improvement District (DCSID) service area includes all land within Douglas County in the Lake Tahoe Basin. Commercial uses in the DCSID service area account for an unusually high share of land use. The casinos at Stateline on the south shore are major contributors to sewage flows.

Based on the Douglas County assessor's information (1977-78) DCSID has a total of 4,510 assessed parcels within its service and collection area. Of these, 2,364 are unimproved parcels. (An unimproved parcel is defined as having improvements assessed at less than $1000. Douglas County assesses property at 35 percent of full market value). Table D-2 shows assessor's estimates of improved and unimproved parcels within the DCSID service and collection area. The Douglas County building inspector's office estimates that there are only 200 to 300 remaining buildable lots in the basin area of Douglas County, and that all of these are in high erosion hazard areas or within 300 feet of the lake shoreline. All other lots are in fact either already built out but not recorded by the assessor or are unbuildable because of steep slopes or proximity to the shoreline. From 1970 to August 1978, a total of 2,474 building permits were issued in Douglas County. The Douglas County building inspector predicts that at the present rate of development, remaining lots will be built out in 1979 (Smith, pers. comm.).

Approximately 70 percent of land in the basin is publicly owned and in recreation and open space use. Recreation use is discussed in the text of this report. Other uses of public lands are permitted as follows:

1) U.S. Forest Service administers special use permits for about 600 summer homes, one winter sports development (Heavenly Valley), 4 resorts, and 5 organization sites.

2) U.S. Forest Service permits limited use of forest land for range. Approximately 375 head of domestic livestock graze on national forest land.

3) Fuel wood permits are issued by the U.S. Forest Service. Permits issued in 1975 were for a total of 2,172 cords.

4) U.S. Department of the Interior, Bureau of Reclamation, administers 64 acres near Tahoe City. The bureau has an agreement with the Tahoe-Carson Irrigation District, which has subleased the land for various uses, including a trailer park. This agreement is being terminated.

5) A total of 727 acres in the basin are used for public services such as schools, utilities, and government offices.

TABLE D-1

LAND AREA IN LAND USE DISTRICTS AND AVAILABLE LAND REMAINING IN 1978 AND UNDER GROWTH SCENARIOS

	1978	Growth Scenarios 1	2	3	4	5
Land area in land use districts						
STPUD						
Residential						
Lots	13,483	15,555	23,483	19,519	15,555	23,483
Dwelling units	16,583	18,655	26,583	22,619	18,655	26,583
General commercial						
Million square feet	3.7	4.4	5.7	5.1	4.1	5.8
Acres	43	51	65	59	47	66
Tourist commercial						
Rooms	7,450	8,450	9,570	10,330	8,450	11,250
Acres	373	423	479	517	423	563
DCSID						
Residential						
Total dwelling units	2,985	4,652	4,652	9,620	17,853	17,853
Acres	1,075	1,478	1,478	1,972	2,252	2,252
Single family dwelling units	1,870	2,917	2,917	3,971	4,183	4,183
Acres	935	1,279	1,279	1,613	1,688	1,688
Multi-family dwelling units	1,115	1,735	1,735	3,964	7,035	7,035
Acres	140	199	199	359	564	564
General commercial						
Million square feet	0.7	1.3	1.1	1.9	3.3	3.4
Acres	6	10	8	15	25	26
Tourist commercial						
Rooms	2,210	3,210	3,210	5.090	10,160	7,360
Acres	55	80	80	127	254	184
Gaming (thousand square feet)	190	190	190	240	300	300

(Continued)

TABLE D-1 (Continued)

		Growth Scenarios				
	1978	1	2	3	4	5
Available land remaining (year 2000)						
STPUD						
Residential						
Lots	10,000	7,298	-0-	3,964	7,298	-0-
Percent	-	79	-0-	39	79	-0-
General commercial						
Acres	21	13	-2	6	16	-3
Percent		59	-1	27	-12	-1
Tourist commercial						
Acres	213	163	107	69	163	23
Percent		77	50	32	77	11
DCSID						
Residential						
Acres	1,177	403	403	280	-0-	-0-
Percent		34	34	24	-0-	-0-
General commercial						
Acres	22	18	19	12	2	6
Percent		81	86	55	1	27
Tourist commercial						
Acres	93	68	68	21	-106	-36
Percent		73	73	23	-113	-39

TABLE D-2

IMPROVED AND UNIMPROVED PARCELS, ASSESSOR'S ESTIMATE DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. I

Service Area	Improved Parcels	Unimproved Parcels*	Total Parcels
DCSID #I	357	180	537
Kingsburg GID	706	1,247	1,953
Roundhill GID	268	204	472
Elk Point SD	79	7	86
Tahoe-Douglas SD	736	726	1,462
Total:	2,146	2,364	4,510

*Unimproved parcels are defined as parcels with improvements assessed at less than $1,000. (Douglas County assesses property at 35 percent of full market value.)

Source: Douglas County Assessor: Douglas County Taxes 1977-78 (computer print-outs).

COMPARISON OF TRPA AND CTRPA LAND USE PLANS

Land use on private lands in the basin is regulated by CTRPA and TRPA. CTRPA's Regional Plan states that "the California legislation establishing CTRPA and mandating the adoption of a regional plan is not in conflict with the TRPA compact", but that CTRPA "is designed to provide independent protection for the California side of the Basin" (CTRPA, 1975b, pp. 5). However, effectuation of the CTRPA regional plan through the land use ordinance would result in differences in land use, primarily in the area of land coverage; there are also some changes in permitted uses and densities allowed by CTRPA. The CTRPA regional plan adopted the original land capability system with restricted overrides allowed on its land coverage standards for each capability district. (TRPA general plan adopted the land capability map, but increased significantly permitted land coverage by excluding roads and other easements from the percentage coverage permitted.) CTRPA overrides are allowed only when specific criteria are met by the parcel. Changes by CTRPA in permitted uses are more restrictive densities allowed for residential uses and changes in outdoor recreation. Table D-3 shows differences between CTRPA and TRPA permitted land uses. Table D-4 compares CTRPA and TRPA allowable densities.

Implementation of the CTRPA general plan would reduce the ultimate population on the California side by 43,000 persons. The TRPA plan calls for an increase of 3.1 times the current basin population; the CTRPA plan would increase the basin population by 2.6 times its present size. Table D-5 compares estimated CTRPA and TRPA summer populations for the California side of the basin.

Significant for future land use is the provision in the land use ordinance that "85 percent of the vacant parcels of record as of August 29, 1975, within the subregion" must have been used for the "construction of at least one dwelling unit or allowable commercial structure," before CTRPA will "consider or approve any proposal for subdivision, minor subdivision, lot split, or parcel division for residential development." (CTRPA, 1975a). This provision in effect freezes 4,200 unsubdivided acres in California designated by TRPA for residential and commercial uses until the existing subdivided but unbuilt lands are built out. As a result, these additional acres on the California side may possibly be removed from development potential through lack of available public services, findings by CTRPA that they are environmentally unsuited for development, or prior acquisition by public interests. Table D-6 shows ultimate population projected for buildout of the 4,200 acres zoned by TRPA but not subdivided.

Nonconforming uses constitute a further conflict between the TRPA and CTRPA plans. Table D-7 shows the difference in acres between existing land uses and TRPA general plan designations. Rural estates and medium-density residential designations have more acres in use than planned for. Nonconforming uses also occur in actual land coverage and densities compared to allowable land coverage and densities under both TRPA and CTRPA. Actual land coverage far exceeds CTRPA's allowable land coverage, especially in commercial areas. CTRPA estimates that between 50 percent and 70 percent of the commercial uses in the south shore area are nonconforming (Widby, pers. comm.).

TABLE D-3

TRPA AND CTRPA GENERAL PLANS: PERMITTED LAND USES

	Land Use Districts										
	General Forest (GF)	Conservation Reserve (CR)	Recreation (Rec)	Rural Estate (RE)	Low Density Residential (LDR)	Medium Density Residential (MDR)	High Density Residential (HDR)	Medium Tourist Residential (MTR)	Tourist Commercial (TC)	General Commercial (GC)	Public Service (PS)
RESIDENTIAL											
Single Family (1/acre)				●	■						
Accessory Guest House & Stables				●							
Single Family (4/acre)					○	■					
Single Family (8/acre)						○	■	●	■		
Single Family (15/acre)							○		○		
Multiperson Dwellings (25 persons/acre)								●			
Multiperson Dwellings (40 persons/acre)							●		●		
Mobile Home Parks (6 units/acre)								●			
Mobile Home Parks (8 units/acre)							●		●		
Low Income Housing (15 units or 40 persons/acre)							■		■		
TOURIST RESIDENTIAL											
Transient Dwellings With Kitchens (15 units/acre)								■			
Transient Dwellings With 10+ Kitchens (20 units/acre)									■	■	
Transient Dwellings (25 units/acre)								■			
Transient Dwellings (40 units/acre)									●	●	
Recreation Vehicle (15 units/acre)									●	●	
OUTDOOR RECREATION											
Hiking	●	●	●								
Developed Campgrounds	●	●	●		■	■	■	■	■	■	
Riding Trails, Corrals, & Stables	●	●	●		■	■	■	■	■	■	
Organized Camps	●	●	●		■	■	■	■	■	■	
Skiing	○	○	○						●	●	
Day Use Areas			●		●	●	●	●	●	●	
Outdoor Recreation Concessions			●								
Private Recreation Areas				●	●	●	●	●	●	●	
Hiking & Riding Trails				●	●	●	●	●	●	●	
Outdoor Amusement Facilities								●	●	●	
Cross Country Ski Areas	■	■			■	■	■	■	■	■	
Snow Play Areas	■	■			■	■	■	■	■	■	
RESOURCE MANAGEMENT & AGRICULTURE											
Growing & Harvesting Timber	■	■			■						
Timber & Forest Products Removal	●	●			■						
Forest Management	●	●	●	●	●	●	●	●	●	●	●
Grazing Livestock	●	●									
Fish & Wildlife Management	●	●									
Fire Lookouts	●	●									
PUBLIC											
Major Roads & Water Crossings	●	●	●	●	●	●	●	●	●	●	●
Broadcast & Microwave Stations	●	●	■								
Overhead & Underground Utilities	●	●	●	●	●	●	●	●	●	●	●
Historic Sites	●	●	●	●	●	●	●	●	●	●	●
Fire Protection Facilities	●	●	●	●	●	●	●	●	●	●	●
Water Storage Tanks & Reservoirs	●	●	●	●	●	●	●	●	●	●	●
Sewage Lift Stations	●	●	●	●	●	●	●	●	●	●	●
Electrical Substations	●	●	●	●	●	●	●	●	●	●	●
Avocational Education Facilities			●	■	○	○	○	○	○	○	○
Communication Equipment				●	●	●	●	●	●	●	●
Religious Facilities					●	●	●	●	●	●	●
General Education Facilities					●	●	●	●	●	●	●
Water Treatment Plant					●	●	●	●	●	●	●
Childcare Nurseries						●	●	●	●	●	●
Police Protection Facilities						●	●	●	●	●	●
Medical Facilities						●	●	●	●	●	●
Cultural Facilities							●	●	●	●	●
Transportation Facilities								●	●	●	●
Vocational Education Facilities										●	●
Post Office Facilities										●	●
Incarceration Facilities										●	●
Solid Waste Transfer Stations										●	●
Airports											●
COMMERCIAL & INDUSTRIAL											
Home Occupations					●	●	●	●	●	●	
Tract Offices					○	○	○	○	○	○	
Professional Offices							●	●	●	●	
Indoor Amusement Facilities							●	●	●	●	
Limited Commercial									●	●	
Service Stations									○	○	
Commercial										●	
Light Industrial										●	
Batch Plants										●	
Bulk Storage										●	
Electric Powerplant										●	
Wrecking Yard										●	

LEGEND

● Use permitted within TRPA and CTRPA land use districts

○ Use permitted within TRPA land use districts only

■ Use permitted within CTRPA land use districts only

Source: TRPA, Lake Tahoe Basin Water Quality Management Plan, Vol. III, February, 1977.

TABLE D-4

CTRPA AND TRPA ALLOWABLE DENSITIES[1]

Land Use Classification	CTRPA	TRPA
Low Density Residential (LDR)	1	4
Medium Density Residential (MDR)	4	8
High Density Residential (HDR)	8 40[2]	15 40[2]
Rural Estates (RE)	1	1
Tourist Commercial (TC)	8 40[2] 20[3]	15 40[2] 40[3]
General Commercial (GC)	20[3]	40[3]
Medium Tourist Residential (MTR)	— 25[2] 20[3]	8 25[2] 25[3]

---

[1] Densities are expressed as the number of single family dwelling units per acre unless otherwise indicated.

[2] Densities are expressed as the number of multiperson dwelling units per acre.

[3] Densities are expressed as the number of transient dwelling units per acre.

Source: CTRPA, Land Use Ordinance, 1975; and TRPA, Land Use Ordinance, 1972.

TABLE D-5

COMPARISON OF CTRPA AND TRPA ESTIMATED SUMMER POPULATION FOR THE CALIFORNIA SIDE OF THE LAKE TAHOE BASIN

CTRPA Plan	1974	1980	1995	Holding Capacity
Single Family	38,623	60,333	89,628	111,303
Multiple Family	12,841	13,261	14,533	23,650
Motel	23,792	24,013	27,563	29,603
Campground	4,491	6,582	13,737	41,977
Total	79,747	104,189	145,461	207,533
Percentage Increase		31%	82%	160%
TRPA Plan				
Single Family	38,623	53,967	79,109	127,504
Multiple Family	12,841	19,424	34,617	60,093
Motel	23,792	26,639	33,089	38,366
Campground	4,491	5,367	9,118	24,700
Total	79,747	105,397	155,933	250,663*
Percentage Increase		32%	96%	213%

---

*Data reported by ERA in error by 1,000 based upon original information from the TRPA Transportation Study Group; 1,000 was added to the two incorrect values.

Source: Economics Research Associates, Social-Economic Impact of the California Tahoe Regional Planning Agency Regional Plan and Land Use Ordinance, 1976.

TABLE D-6

ULTIMATE POPULATIONS PROJECTED FOR BUILDOUT OF 4,200 ACRES ZONED BY TRPA BUT NOT SUBDIVIDED

	Acres	Potential Units	Potential Population
LDR	3,629	10,466	31,398
MDR	112	528	1,320
HDR	286	2,186	5,465
TC	65	2,600	5,200
GC	108	1,440	2,880
Total	4,200	17,220	46,263

These population estimates are made by taking number of acres, screening for land capability, determining the number of units possible and multiplying by persons per unit (LDR - 3/u; MDR and HDR - 2.5/u; TC and GC - 2/u).

Source: California Tahoe Regional Planning Agency, Environmental Impact Report: Draft Regional Plan (draft), 1975, pp. IV. 32, 34.

TABLE D-7

DIFFERENCE BETWEEN EXISTING LAND USE AND TRPA GENERAL PLAN

District	Existing (acres)	General Plan (acres)	Change Necessary to Achieve General Plan (acres)
RE	2,488	2,337	-151
LDR	13,308	19,198	5,890
MDR	1,626	1,504	-122
HDR	1,074	2,270	1,196
MTR	3	3	0
TC	1,024	1,320	296
GC	1,123	1,503	380
Rec	2,207	4,328	2,121
PS	727	898	171
CR	---	1,753	1,753
GF	174,538	163,004	-11,534
TOTAL	198,118	198,118	0

Source: TRPA, Lake Tahoe Basin Water Quality Management Plan, Vol. III, February 1977.

3. TRANSPORTATION

Basinwide Average Daily Traffic

Figure D-1 shows 1977 annual average daily traffic volumes (AADT) at various locations on principal highways within the Lake Tahoe basin. At some locations the average daily traffic for the peak month of the year is also shown. The AADT varies from 2,500 vehicles per day on California Highway 89 near Emerald Bay, to 38,000 per day on U.S.50 in South Lake Tahoe. The ratio of peak month to annual average ranges from 1.13 near the Stateline in South Lake Tahoe, to 1.82 at Tahoe City.

Figure D-2 shows additional 1977 average daily traffic volumes in the South Lake Tahoe area.

South Shore Daily and Hourly Traffic

Daily and hourly traffic counts on U.S.50 in the south shore area appear to be the most complete and dependable data available on traffic characteristics in the Lake Tahoe basin. Some of the detailed traffic count date are summarized in this appendix for five locations on U.S.50 identified by letters in Figure D-3.

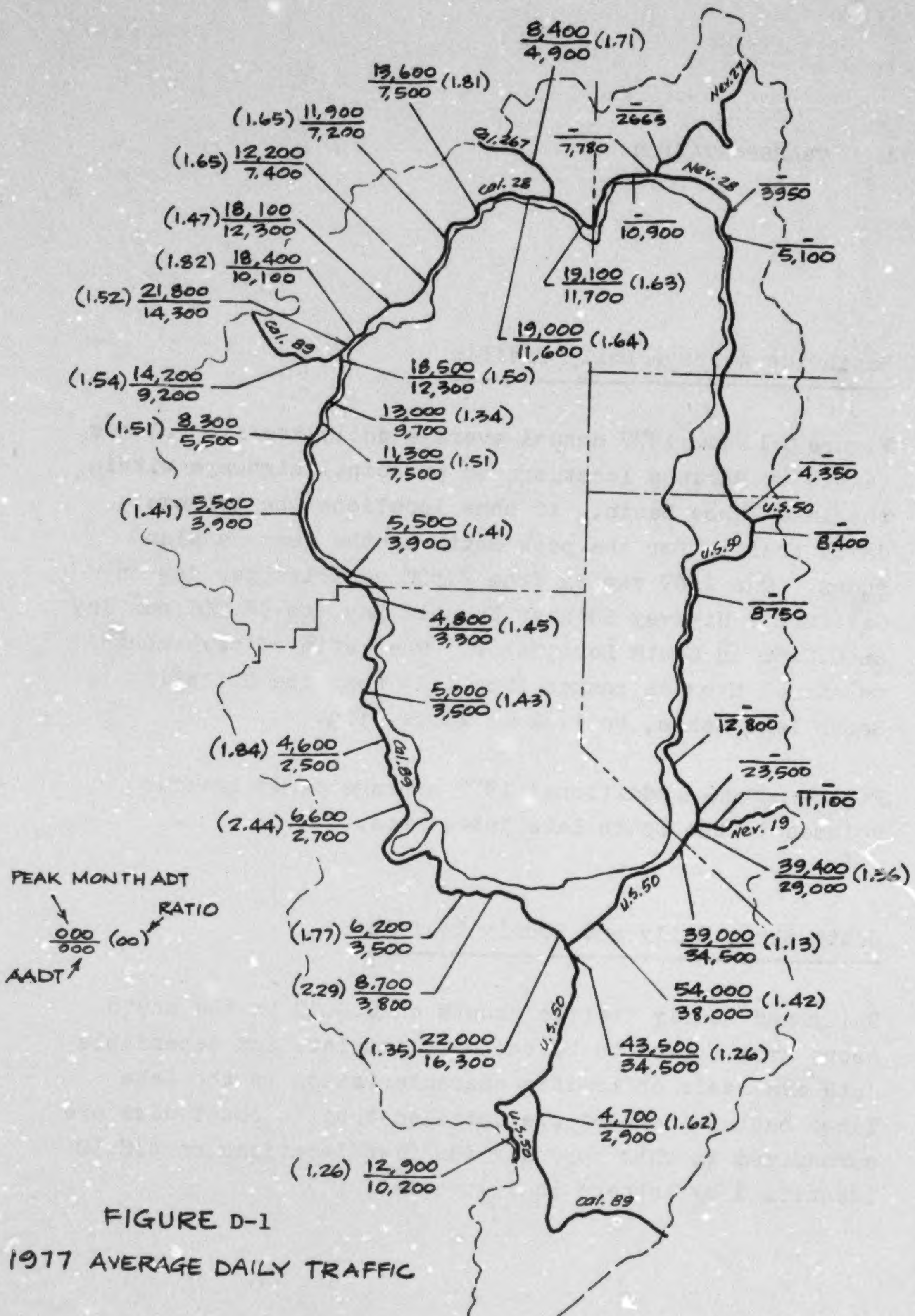


FIGURE D-1

1977 AVERAGE DAILY TRAFFIC

SOURCE: CALIF. & NEVADA ANNUAL TRAFFIC VOLUME REPORTS.

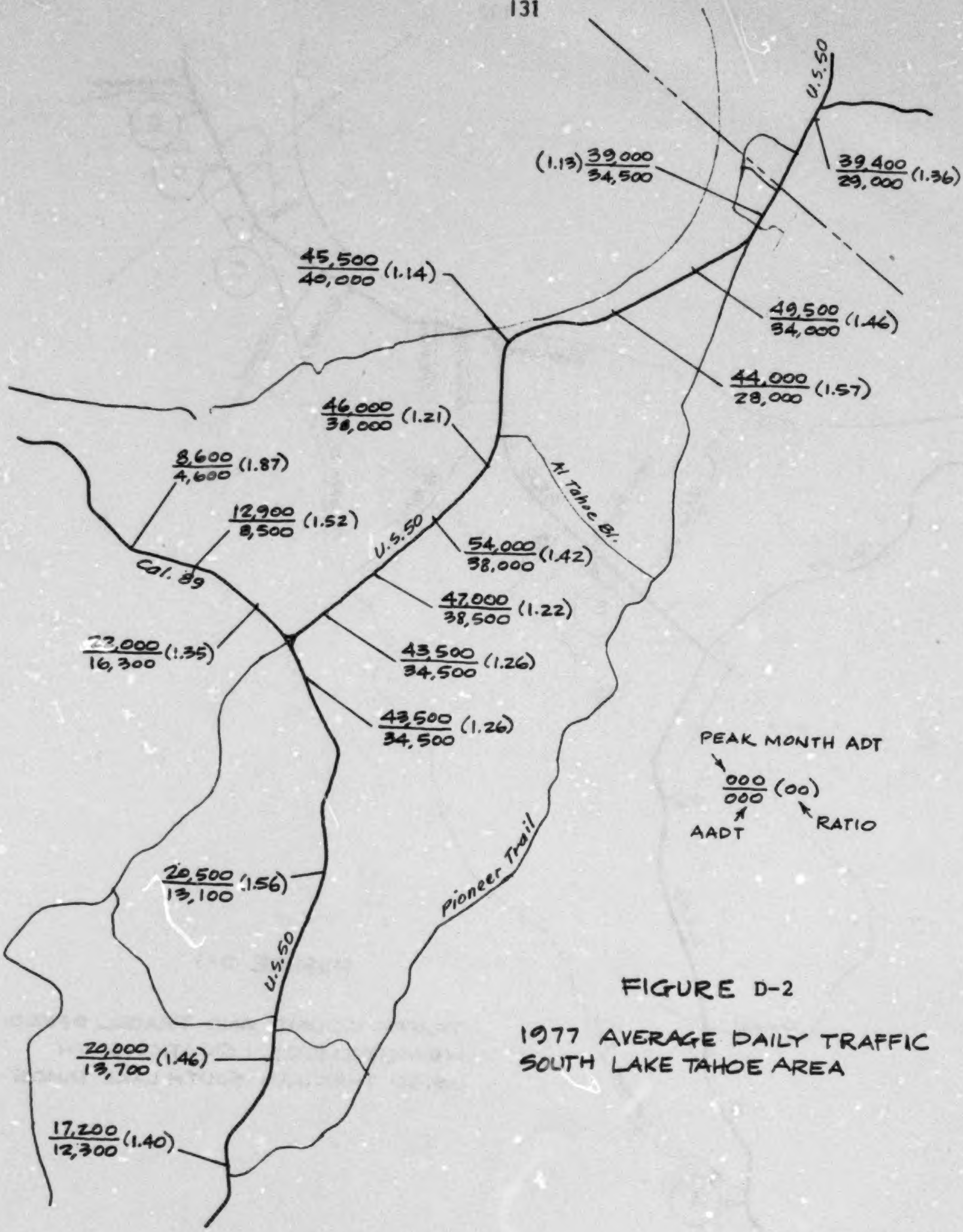


FIGURE D-2

1977 AVERAGE DAILY TRAFFIC
SOUTH LAKE TAHOE AREA

SOURCE: CALIF. & NEVADA ANNUAL TRAFFIC VOLUME REPORTS

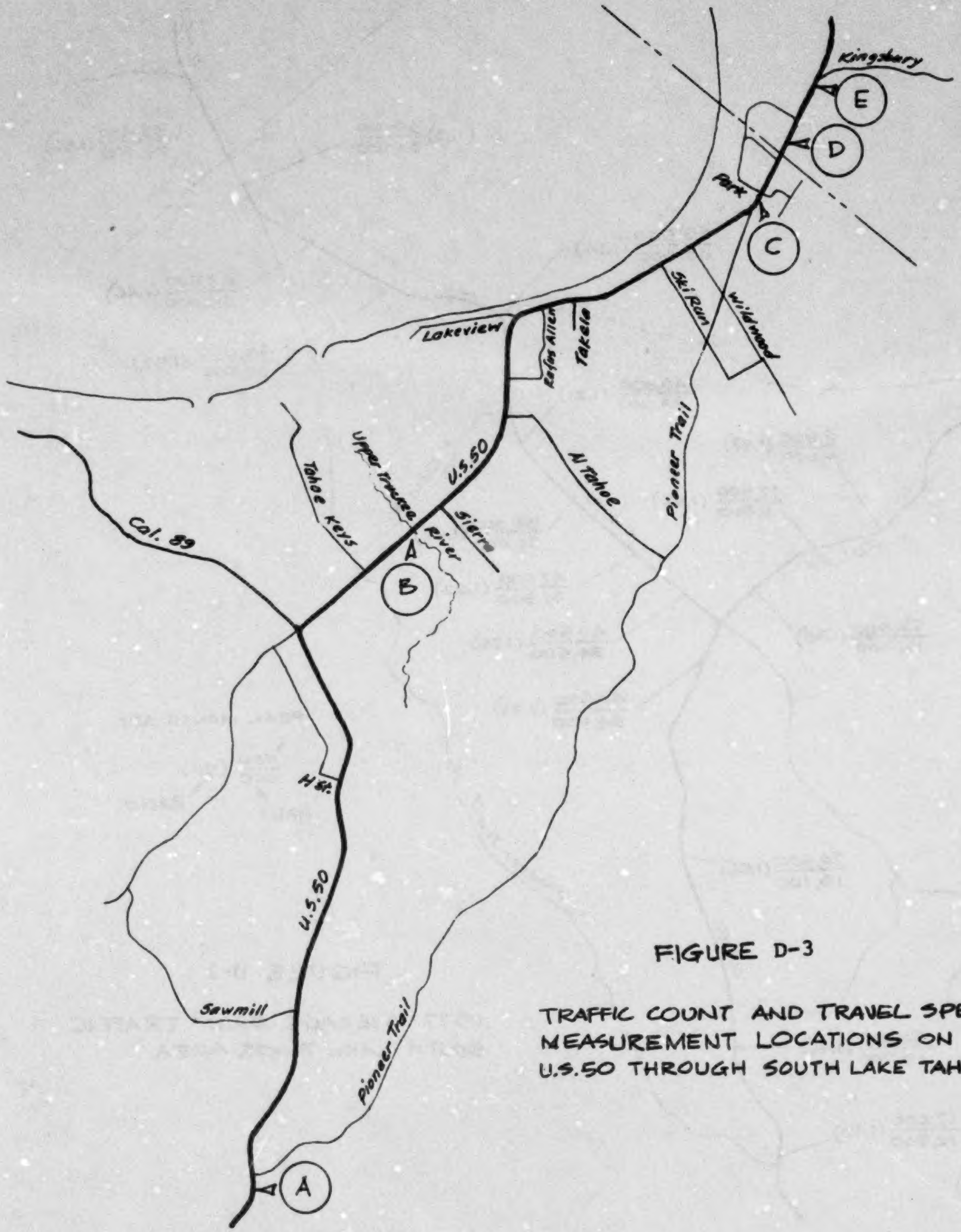


FIGURE D-3

TRAFFIC COUNT AND TRAVEL SPEED MEASUREMENT LOCATIONS ON U.S.50 THROUGH SOUTH LAKE TAHOE

Location A is just west of the junction of U.S.50 and Pioneer Trail near Meyers. Counts at this location were available only for traffic in the westbound direction. Figure D-4 shows daily traffic volumes in January, February, August and September, 1978. The volumes are generally higher in the summer months than in winter, but the volumes peak on weekends in both seasons, and Sundays have the highest volumes in most of the weeks shown. The highest winter volume shown is 80 percent of the highest summer volume shown. In winter, the peak-day volumes are nearly double the average weekday volumes. In summer, the peaks are about 50 percent higher than the average weekday volumes. The highest westbound daily volume shown is 15,570 on Sunday, August 20. The highest shown for winter is 12,463 on Sunday, February 26.

Figure D-5 shows hourly volumes during Sunday, February 26. The peak hourly volume shown is 1,190 between noon and 1 p.m. If the ratio of peak-hour to daily volume were the same on August 20, the highest hourly volume on that day would be about 1,400 vehicles per hour, one-way.

Location B is on the Upper Truckee River Bridge just east of Tahoe Keys in South Lake Tahoe. Daily traffic volumes are shown in Figures D-6, D-7, and D-8. Figure D-6 shows daily volumes during July, 1977. The volumes shown are for traffic in the eastbound direction and for the total volume in both directions. The highest total volume shown is 54,000 on Sunday, July 3. The eastbound traffic peaks on Fridays and Saturdays, rather than Sundays.

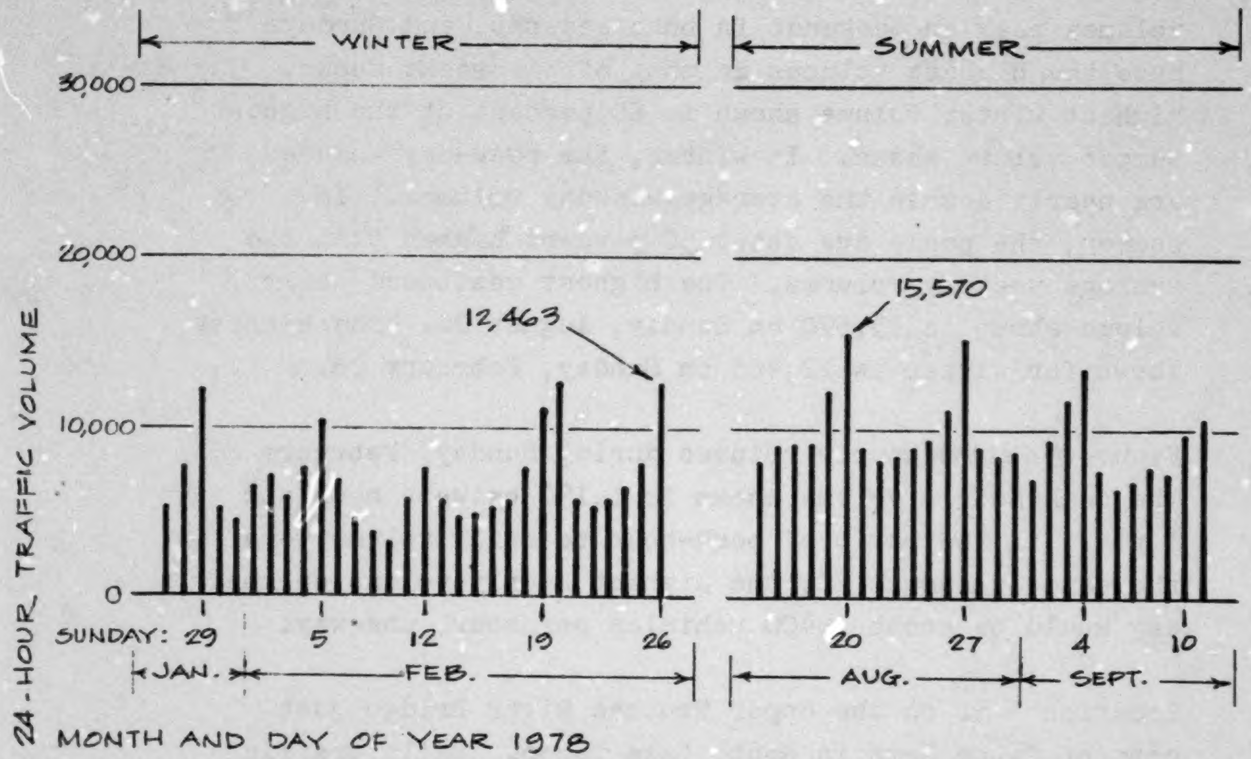


FIGURE D-4

DAILY TRAFFIC COUNTS ON U.S. 50
WEST OF PIONEER TRAIL, AT MEYERS -- LOCATION A
ONE-WAY (WESTBOUND) TRAFFIC ONLY

SOURCE: CALTRANS COUNTS

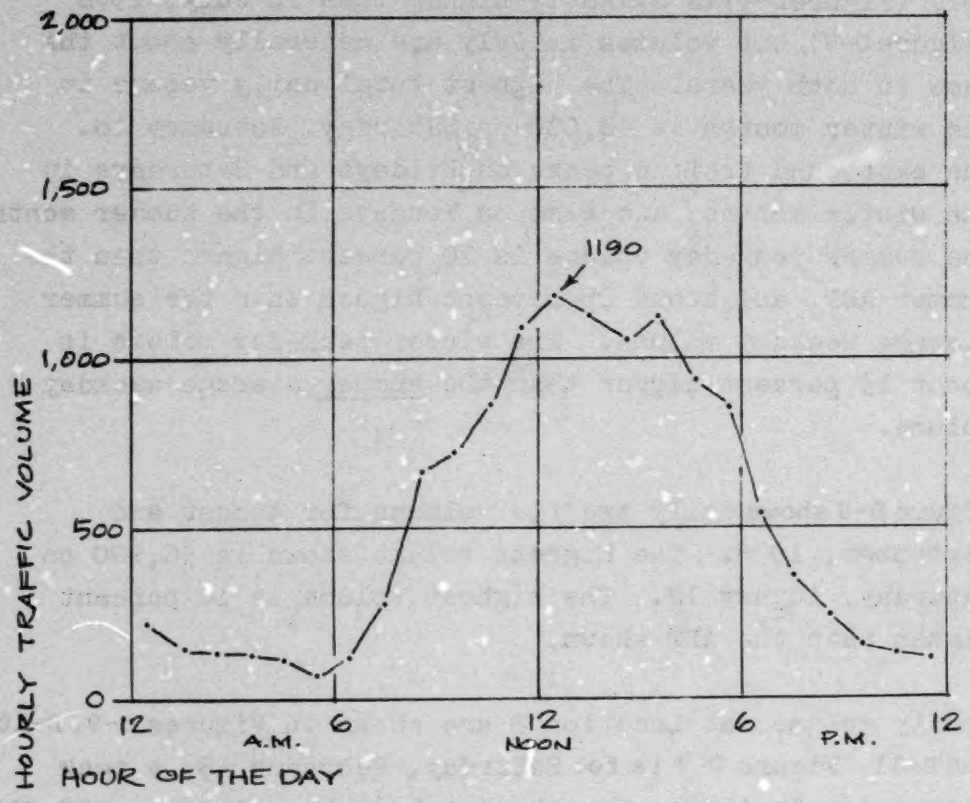


FIGURE D-5

HOURLY TRAFFIC COUNTS ON U.S. 50
WEST OF PIONEER TRAIL AT MEYERS -- LOCATION A
ONE-WAY (WESTBOUND) TRAFFIC ONLY

A WINTER PEAK DAY (SUNDAY, FEB. 26, 1978)

SOURCE: CALTRANS COUNTS

Figure D-7 shows daily traffic volumes in January, February, June and July, 1978. The highest total volume shown is 53,000 on Wednesday, July 5. The highest volume in July, 1977 (Figure D-6) is slightly higher than in July, 1978 (Figure D-7), but volumes in July are generally about the same in both years. The highest total daily volume in the winter months is 48,000 on Saturday, February 18. The eastbound traffic peaks on Fridays and Saturdays in the winter months, and also on Mondays in the summer months. The summer peak-day volume is 10 percent higher than the summer ADT, and about 25 percent higher than the summer average weekday volume. The winter peak-day volume is about 13 percent higher than the summer average weekday volume.

Figure D-8 shows daily traffic volumes for August and September, 1978. The highest volume shown is 56,000 on Saturday, August 12. The highest volume is 10 percent higher than the ADT shown.

Hourly volumes at Location B are shown in Figures D-9, D-10, and D-11. Figure D-9 is for Saturday, February 18, a peak winter day in 1978, when the total daily volume was 48,000. The highest volume in Figure D-9 is about 3,600 vehicles per hour for the total of both directions. The highest eastbound volume is 2,080 vehicles per hour, and is about the same for four consecutive hours. Westbound traffic is about 1,500 vehicles per hour for at least six hours.

Figure D-10 is for Monday, July 3, 1978, when the total daily volume was nearly 53,000. The highest hourly volume is nearly 3,900 for both directions. The peak directional

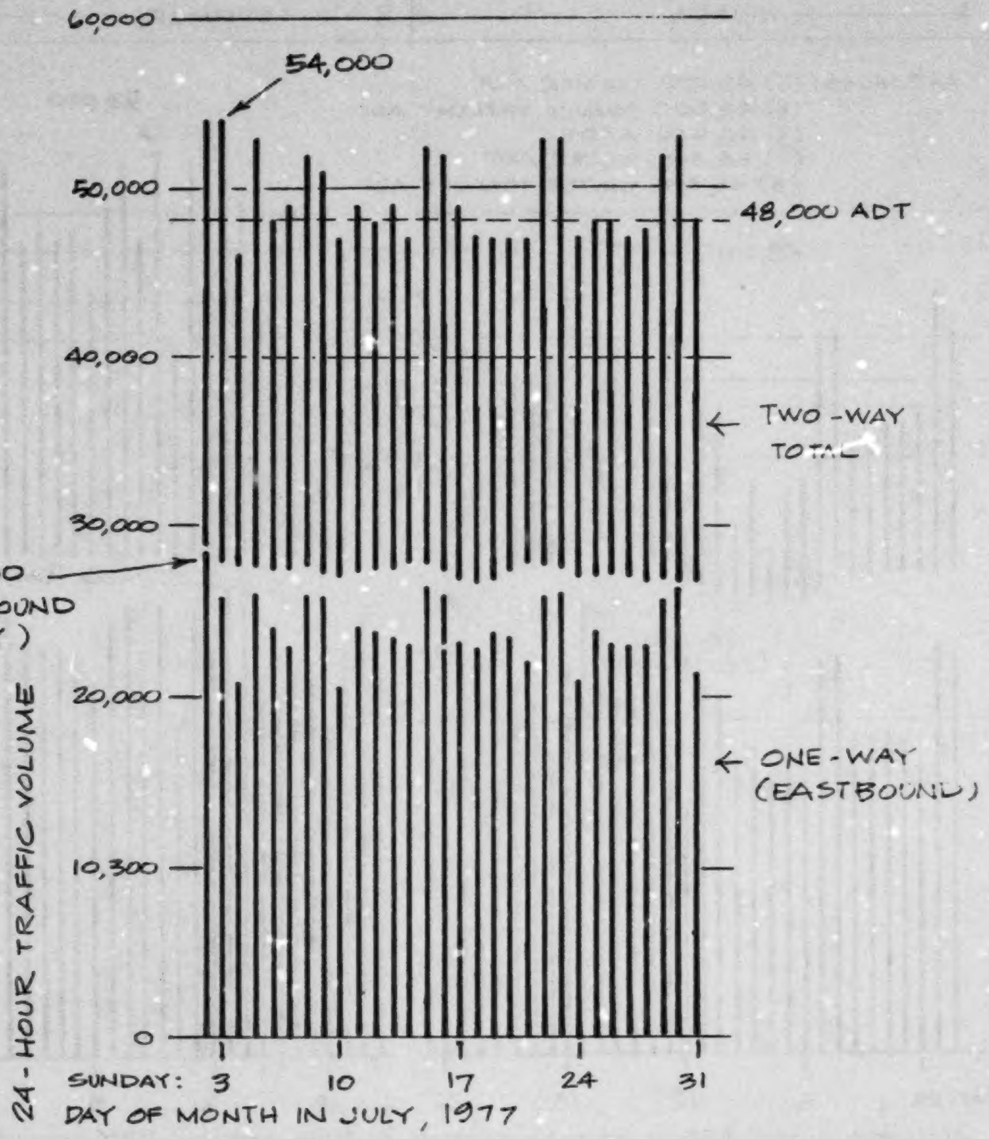


FIGURE D-6

DAILY TRAFFIC COUNTS ON U.S.50
AT UPPER TRUCKEE RIVER BRIDGE -- LOCATION B
SUMMER 1977

SOURCE: CALTRANS COUNTS

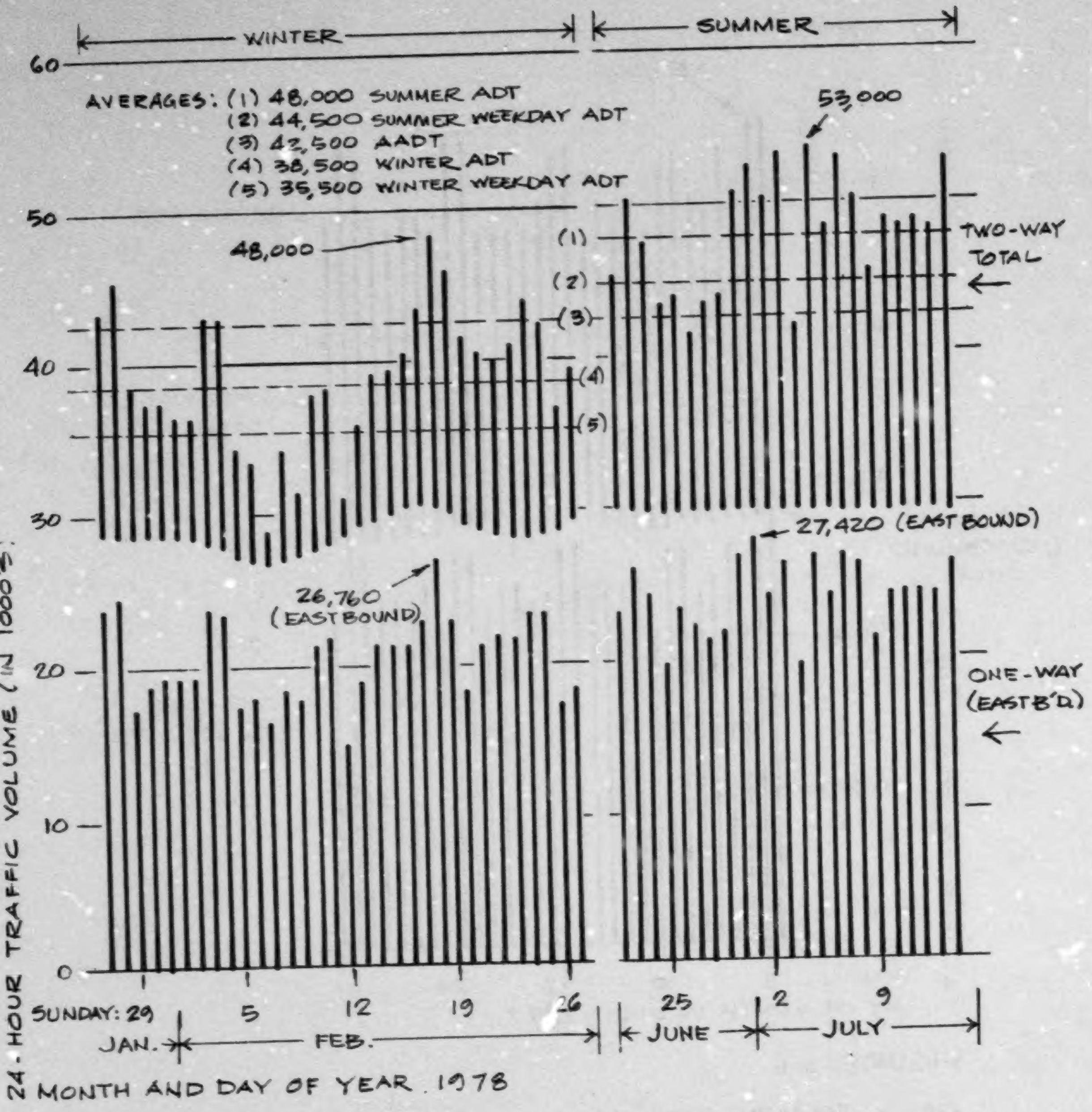


FIGURE D-7

DAILY TRAFFIC COUNTS ON U.S. 50
AT UPPER TRUCKEE RIVER BRIDGE -- LOCATION B

WINTER AND SUMMER, 1978

SOURCE: CALTRANS COUNTS

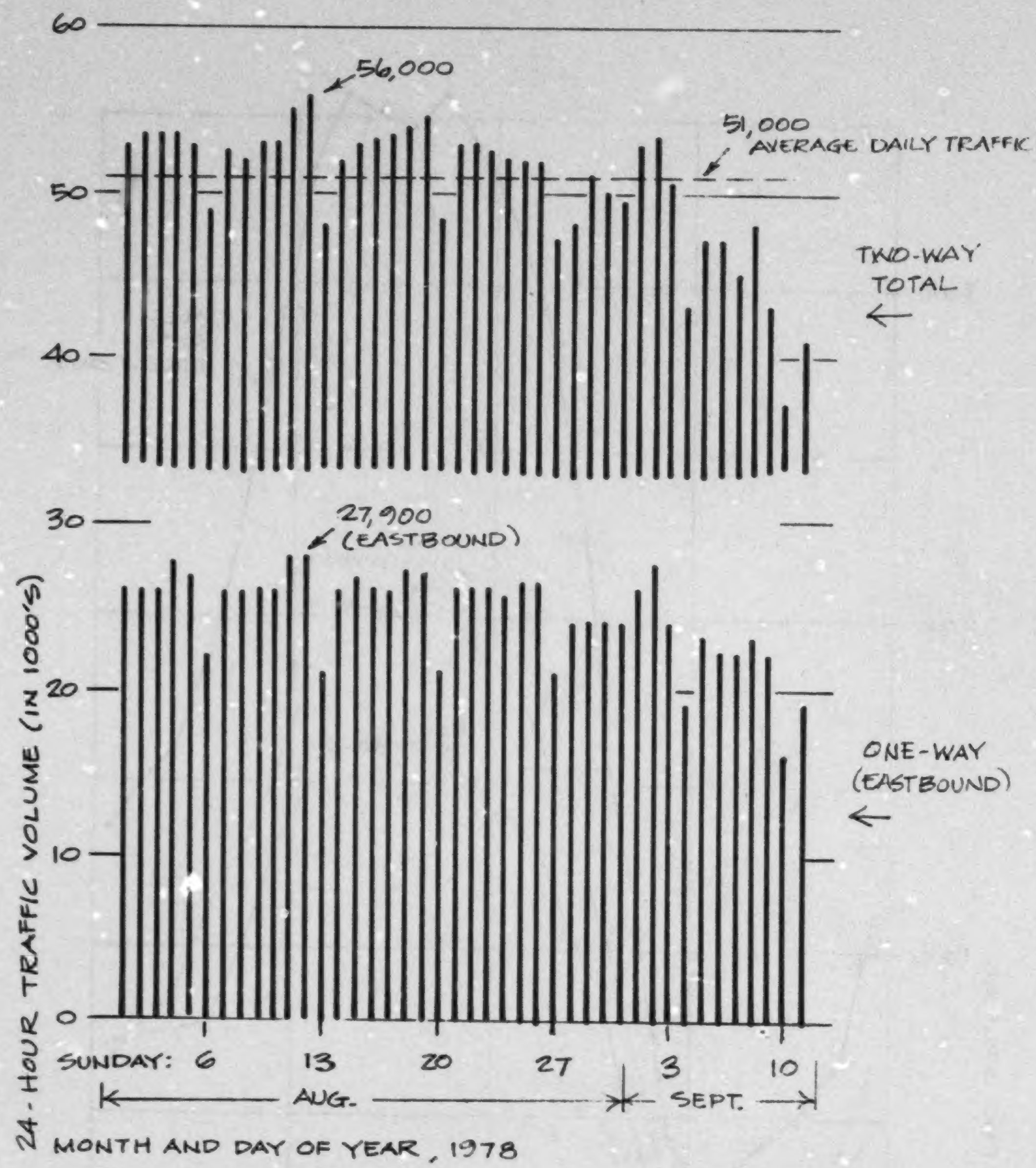


FIGURE D-8

DAILY TRAFFIC COUNTS ON U.S. 50
AT UPPER TRUCKEE RIVER BRIDGE -- LOCATION B

SUMMER, 1978

SOURCE: CALTRANS COUNTS

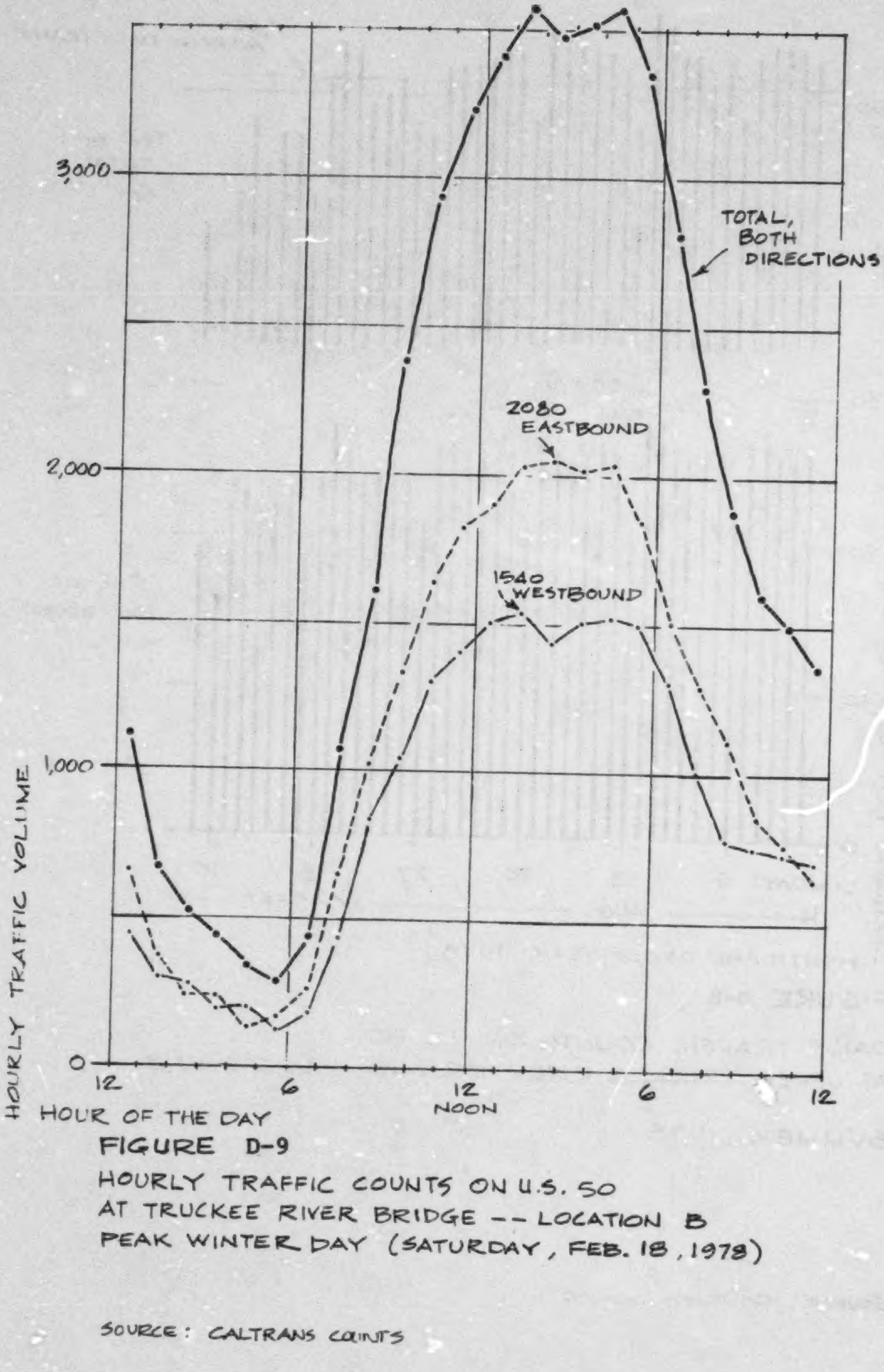


FIGURE D-9

HOURLY TRAFFIC COUNTS ON U.S. 50
AT TRUCKEE RIVER BRIDGE -- LOCATION B
PEAK WINTER DAY (SATURDAY, FEB. 18, 1978)

SOURCE: CALTRANS COUNTS

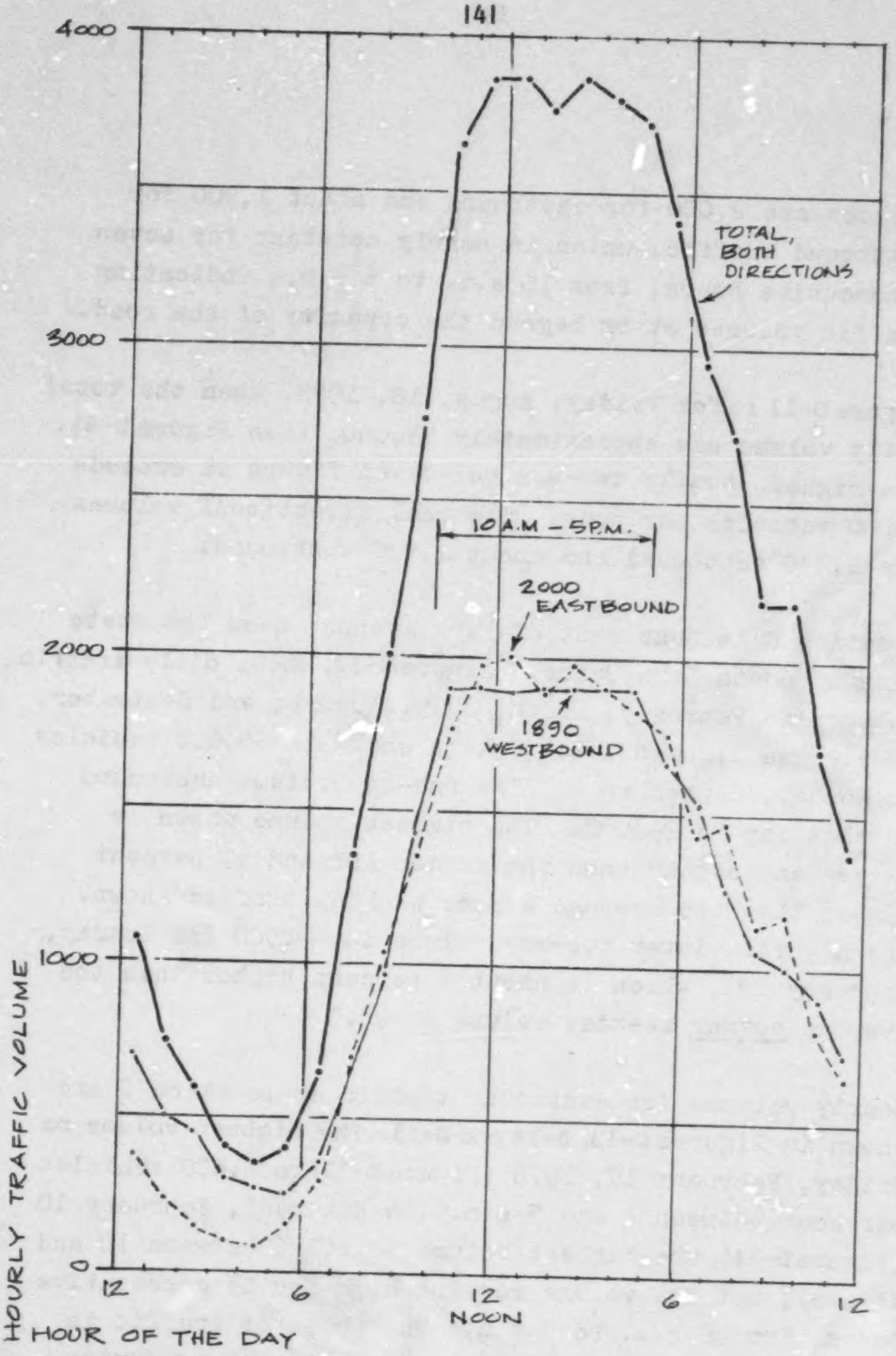


FIGURE D-10

HOURLY TRAFFIC COUNTS ON U.S. 50
AT TRUCKEE RIVER BRIDGE -- LOCATION B
A PEAK SUMMER DAY (MONDAY, JULY 3, 1978)

SOURCE: CALTRANS COUNTS

volumes are 2,000 for eastbound and about 1,900 for westbound traffic, which is nearly constant for seven consecutive hours, from 10 a.m. to 5 p.m., indicating traffic volumes at or beyond the capacity of the road.

Figure D-11 is for Friday, August 18, 1978, when the total daily volume was approximately 54,000. (See Figure D-8). The highest hourly two-way volume on Figure 11 exceeds 4,000 vehicles per hour. The peak directional volumes are 2,240 eastbound and about 1,950 westbound.

Location C is just west of Park Avenue, near the state line in South Lake Tahoe. Figure D-12, shows daily traffic volumes in February, March, July, August, and September, 1978. The highest total volume shown is 55,000 vehicles on Monday, September 4. The one-way volume eastbound on that day is 24,090. The highest volume shown is 12 percent higher than the summer ADT and 17 percent higher than the average summer weekday traffic shown. The highest winter two-way volume is 49,500 (on Sunday, February 19), which is about 8 percent higher than the average summer weekday volume shown.

Hourly volumes for eastbound traffic at location C are shown in Figures D-13, D-14 and D-15. The highest volume on Friday, February 17, 1978 (Figure D-13) is 1,400 vehicles per hour between 4 and 5 p.m. On Saturday, February 18 (Figure D-14), the highest volume is 1,375 between 10 and 11 a.m., but the volume remains high for 13 consecutive hours, from 8 a.m. to 9 p.m. The speed of traffic is only 5 m.p.h. even at the lowest hourly volume during that 13-hour period. The total 24-hour volume on

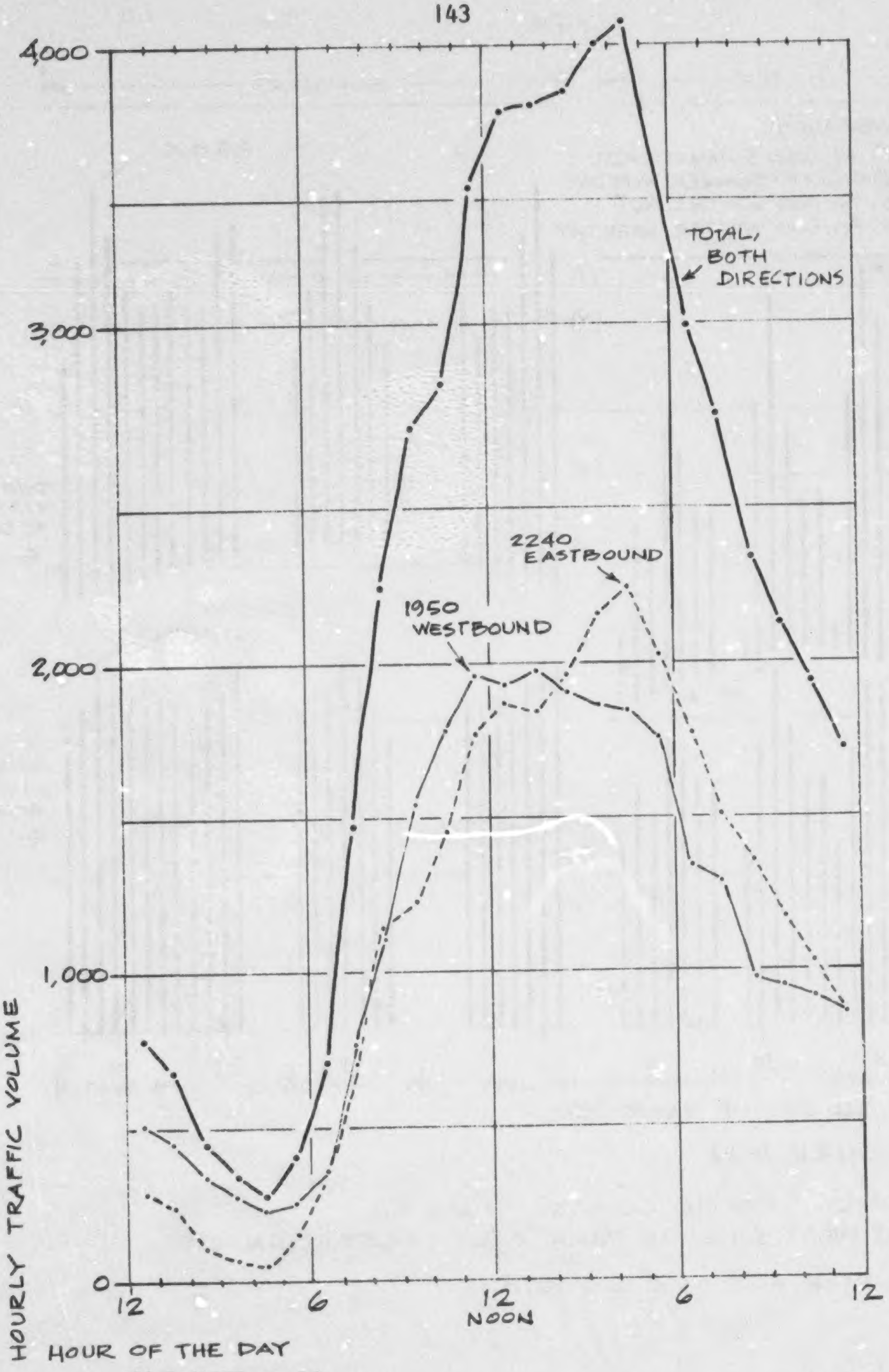


FIGURE D-11
HOURLY TRAFFIC COUNTS ON U.S. 50
AT TRUCKEE RIVER BRIDGE -- LOCATION B
A PEAK SUMMER DAY (FRIDAY, AUG. 18, 1978)

SOURCE: CALTRANS COUNTS

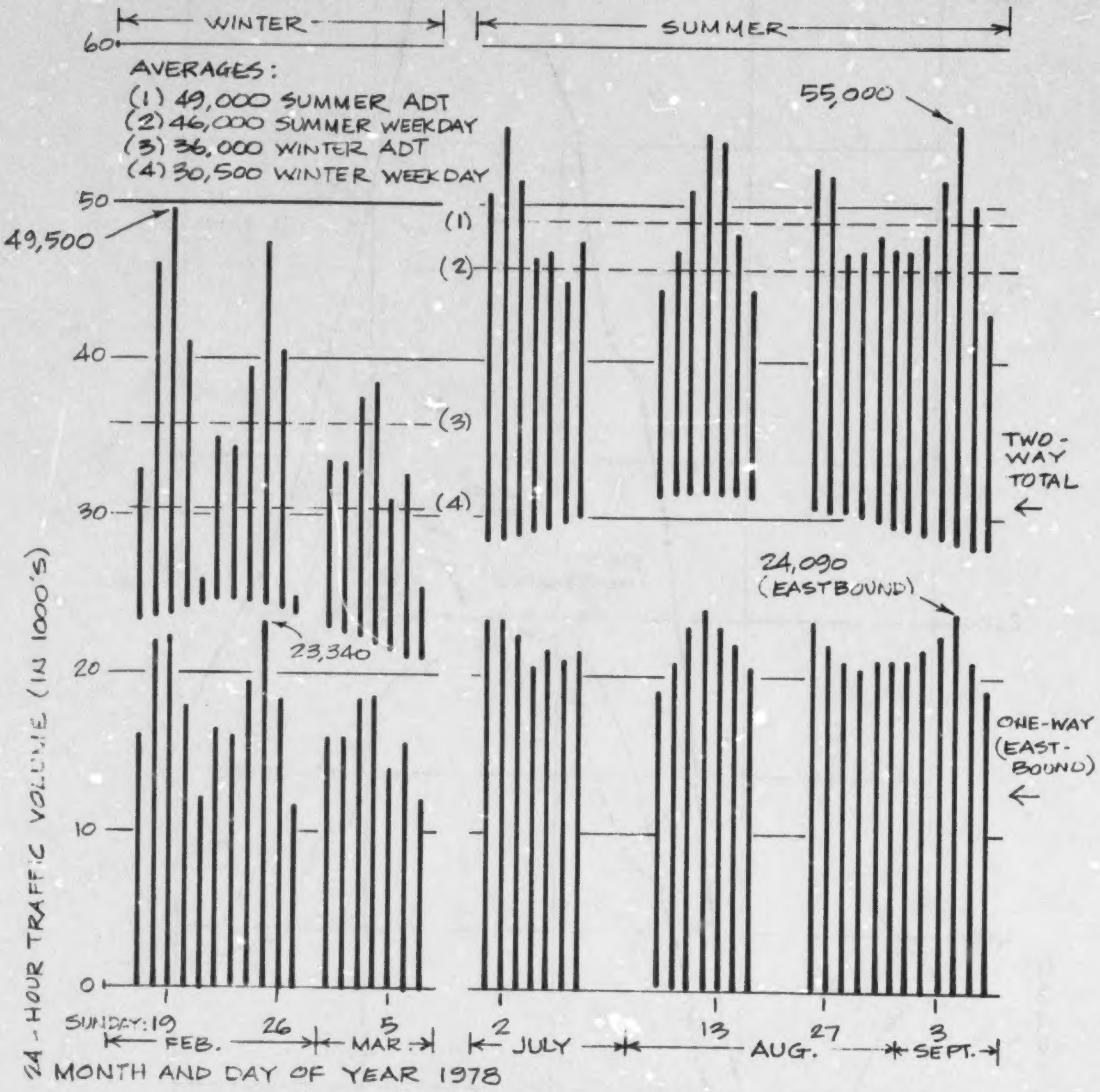


FIGURE D-12

DAILY TRAFFIC COUNTS ON U.S. 50
AT WEST SIDE OF PARK AVE. -- LOCATION C

WINTER AND SUMMER 1978

SOURCE: CALTRANS COUNTS

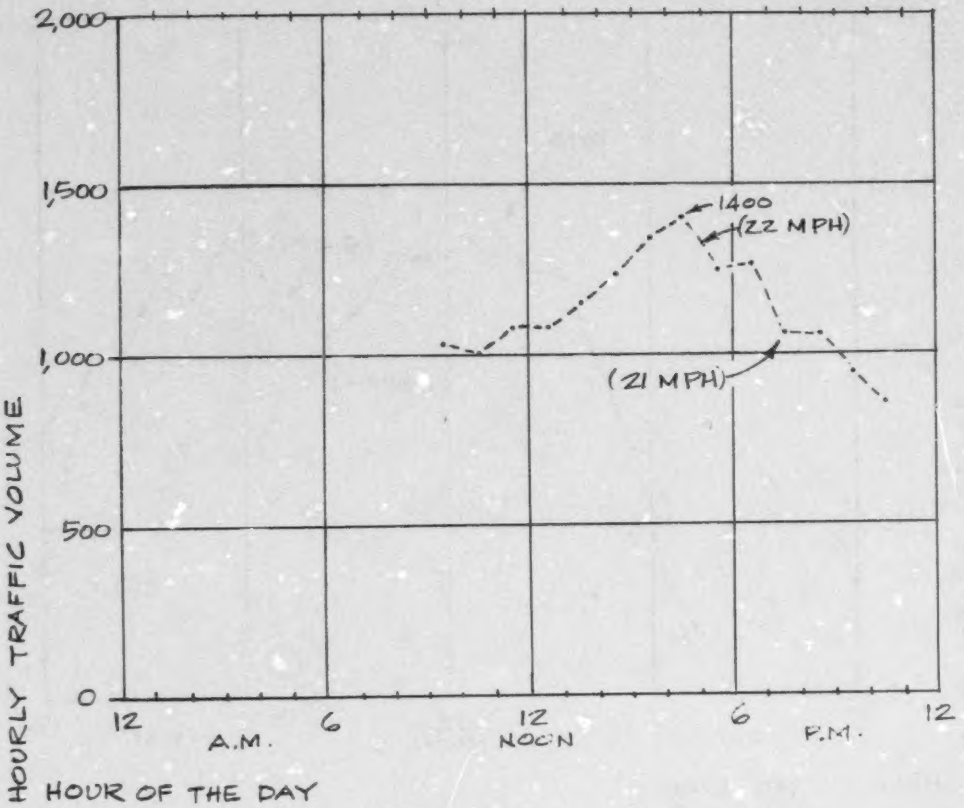


FIGURE D-13

HOURLY TRAFFIC COUNTS ON U.S.50
AT WEST SIDE OF PARK AVE. -- LOCATION C
ONE-WAY (EASTBOUND) TRAFFIC ONLY

A PEAK WINTER DAY (FRIDAY, FEB. 17, 1978)

SOURCE: CTRPA

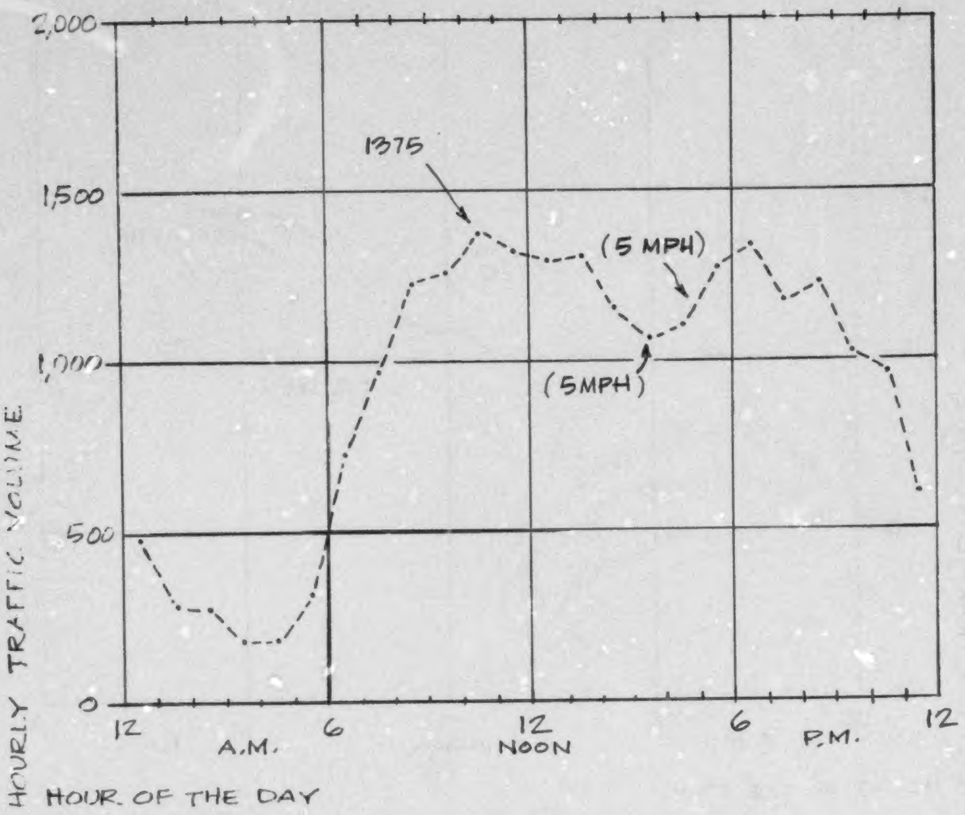


FIGURE D-14

HOURLY TRAFFIC COUNTS ON U.S. 50
AT WEST SIDE OF PARK AVE. -- LOCATION C
ONE-WAY (EASTBOUND) TRAFFIC ONLY

A PEAK WINTER DAY (SATURDAY, FEB. 18, 1978)

SOURCE: CTRPA

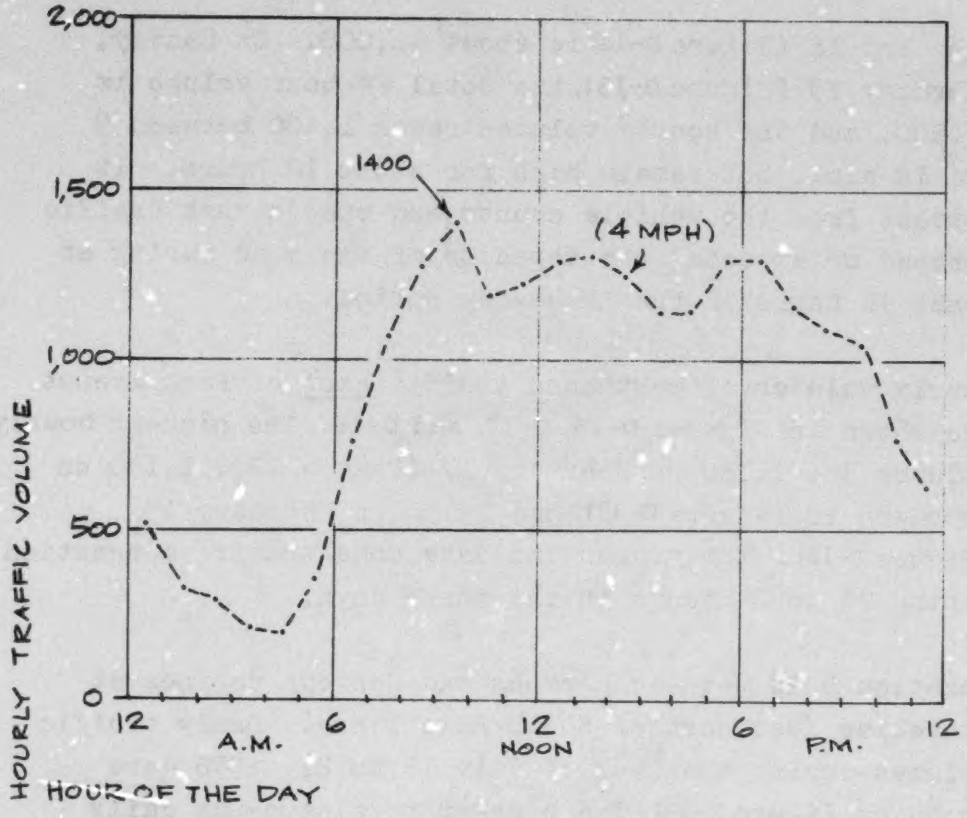


FIGURE D-15

HOURLY TRAFFIC COUNTS ON U.S. 50
AT WEST SIDE OF PARK AVE. -- LOCATION C
ONE-WAY (EASTBOUND) TRAFFIC ONLY

A PEAK WINTER DAY (SUNDAY, FEB. 19, 1978)

SOURCE: CTRPA

February 18 (Figure D-14) is about 46,000. On Sunday, February 19 (Figure D-15), the total 24-hour volume is 49,500, and the hourly volumes reach 1,400 between 9 and 10 a.m., but remain high for about 12 hours. It appears from the vehicle counts and speeds that traffic reached or exceeded the capacity of the road during at least 30 hours in the three-day period.

Hourly volumes of westbound traffic east of Park Avenue are shown in Figures D-16, D-17, and D-18. The highest hourly volumes are 1,180 on February 17 (Figure 16), 1,140 on February 18 (Figure D-17), and 1,250 on February 19 (Figure D-18). The graphs indicate some traffic congestion during 20 to 24 hours in the three days.

Location D is between Harrahs and Harveys casinos at Stateline just east of South Lake Tahoe. Daily traffic volumes during the week of July 15 to 21, 1976, are shown on Figure D-19). The highest total two-way daily volume in that week is 36,919 on Saturday, June 19. Hourly volumes for June 19, 1976, are shown in Figure C-20. The highest hourly volume in one direction (eastbound) is 1,151, but the volume remains within about 10 to 15 percent of that level for about 12 hours (from 10 a.m. to 10 p.m.), indicating that traffic congestion and the capacity of the road prevented the traffic from peaking at a higher volume during that 12-hour period.

Location E is about 250 feet west (or south) of the intersection of Kingsbury Grade (Nevada Highway 19). Daily traffic volumes in the month of June, 1976, are

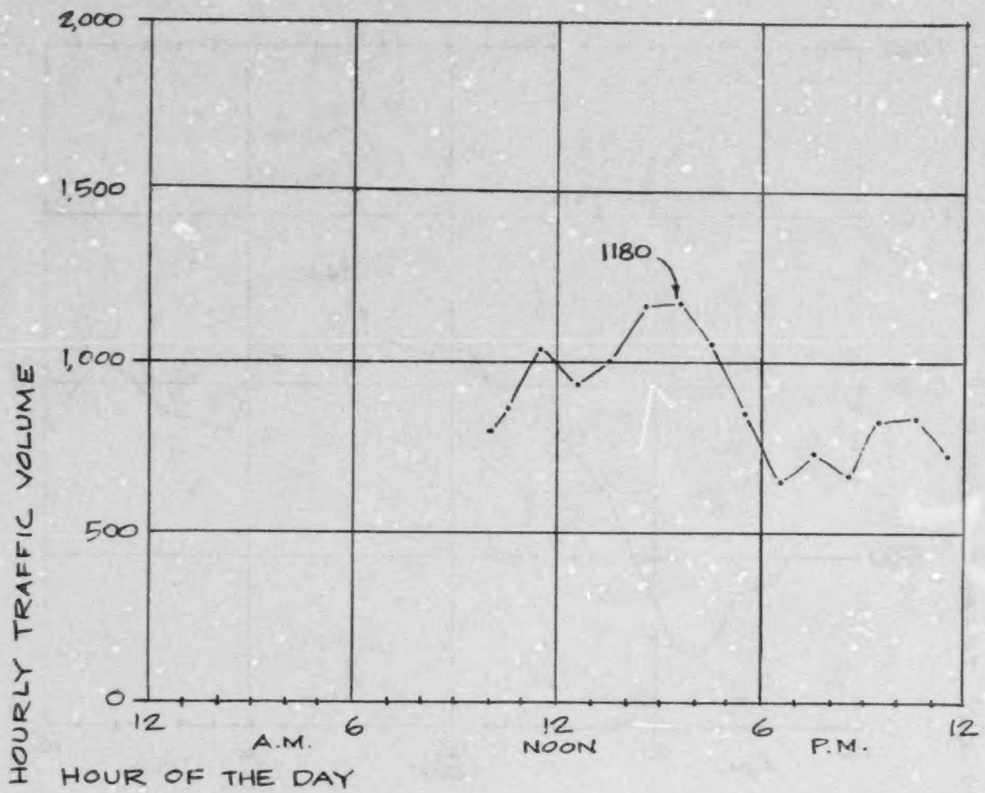


FIGURE D-16

HOURLY TRAFFIC COUNTS ON U.S. 50
AT EAST SIDE OF PARK AVE. -- LOCATION C
ONE-WAY (WESTBOUND) TRAFFIC ONLY

A PEAK WINTER DAY (FRIDAY, FEB. 17, 1978)

SOURCE: CTRPA

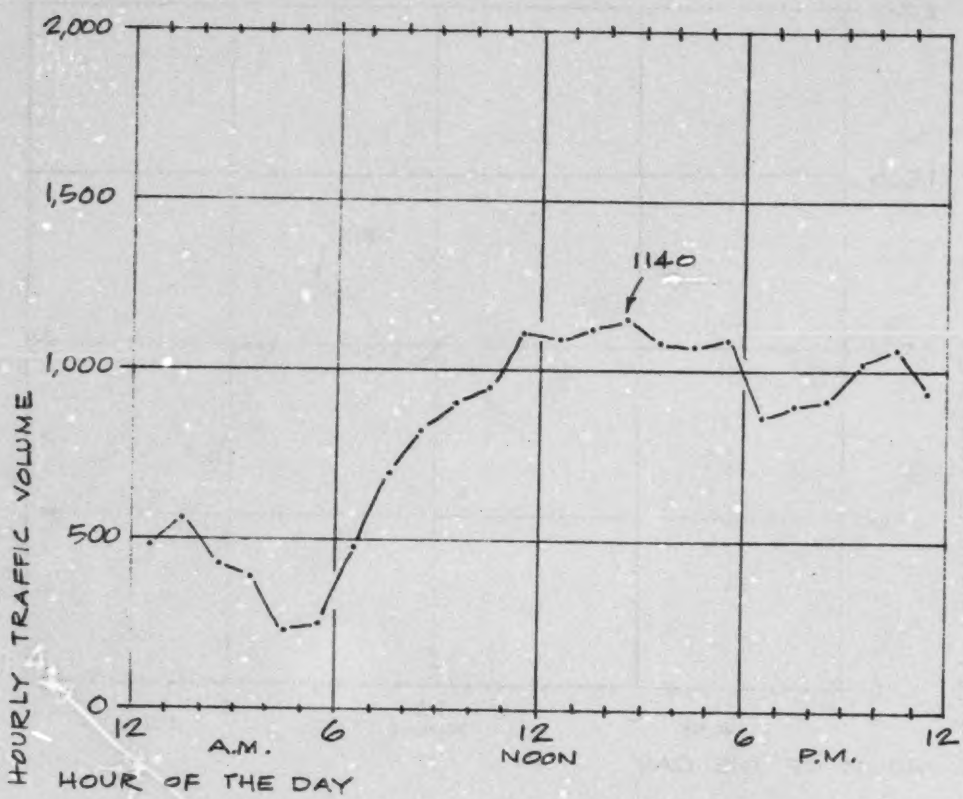


FIGURE D-17

HOURLY TRAFFIC COUNTS ON U.S. 50
AT EAST SIDE OF PARK AVE. -- LOCATION C
ONE-WAY (WESTBOUND) TRAFFIC ONLY
A PEAK WINTER DAY (SATURDAY, FEB. 18, 1978)

SOURCE: CTRPA

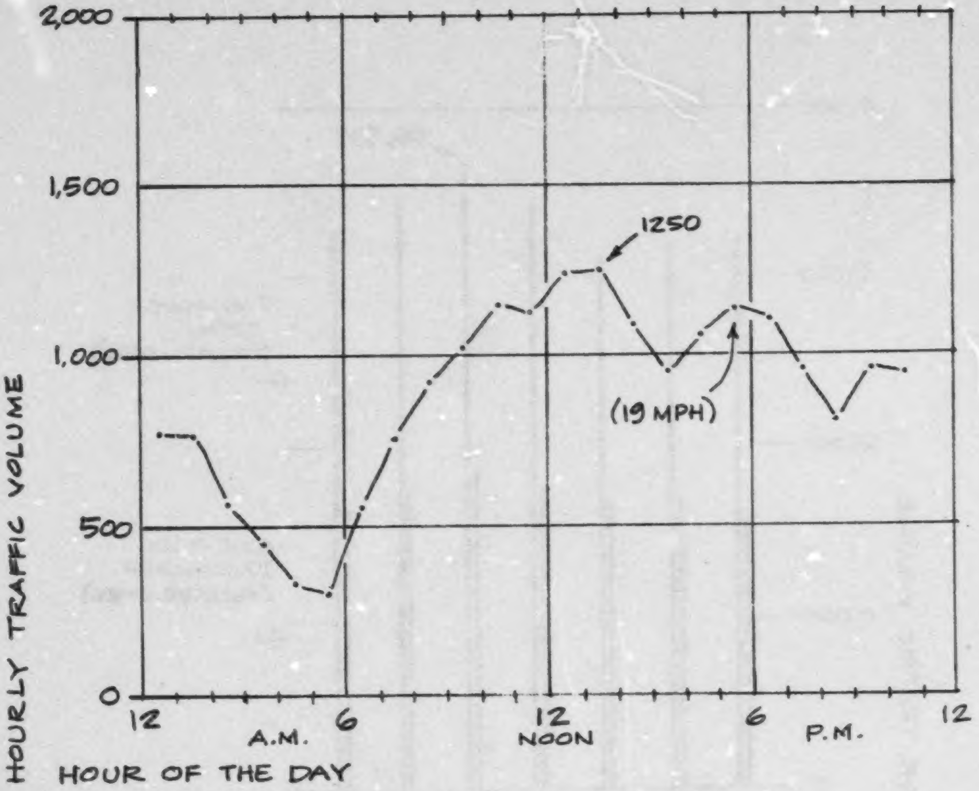


FIGURE D-18

HOURLY TRAFFIC COUNTS ON U.S. 50
AT EAST SIDE OF PARK AVE. -- LOCATION C
ONE-WAY (WESTBOUND) TRAFFIC ONLY

A PEAK WINTER DAY (SUNDAY, FEB. 19, 1978)

SOURCE: CTRPA

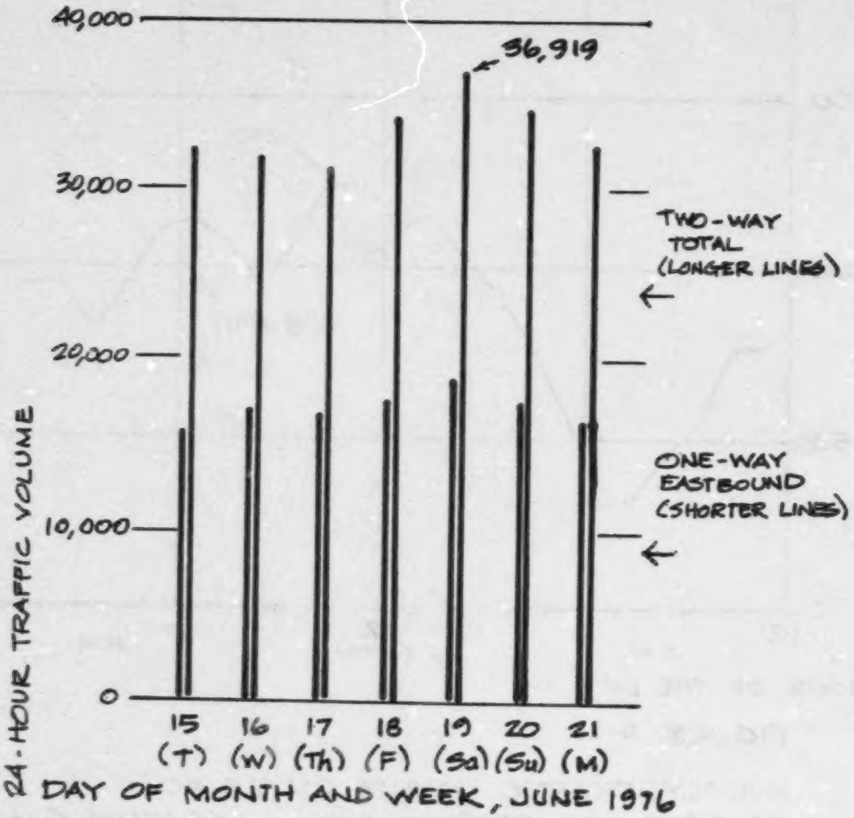


FIGURE D-19

DAILY TRAFFIC COUNTS ON U.S. 50
BETWEEN HARRAHS AND HARVEYS
LOCATION D

SUMMER (JUNE 15 TO 21, 1976)

SOURCE: NEVADA STATE HIGHWAY DEPT. COUNTS

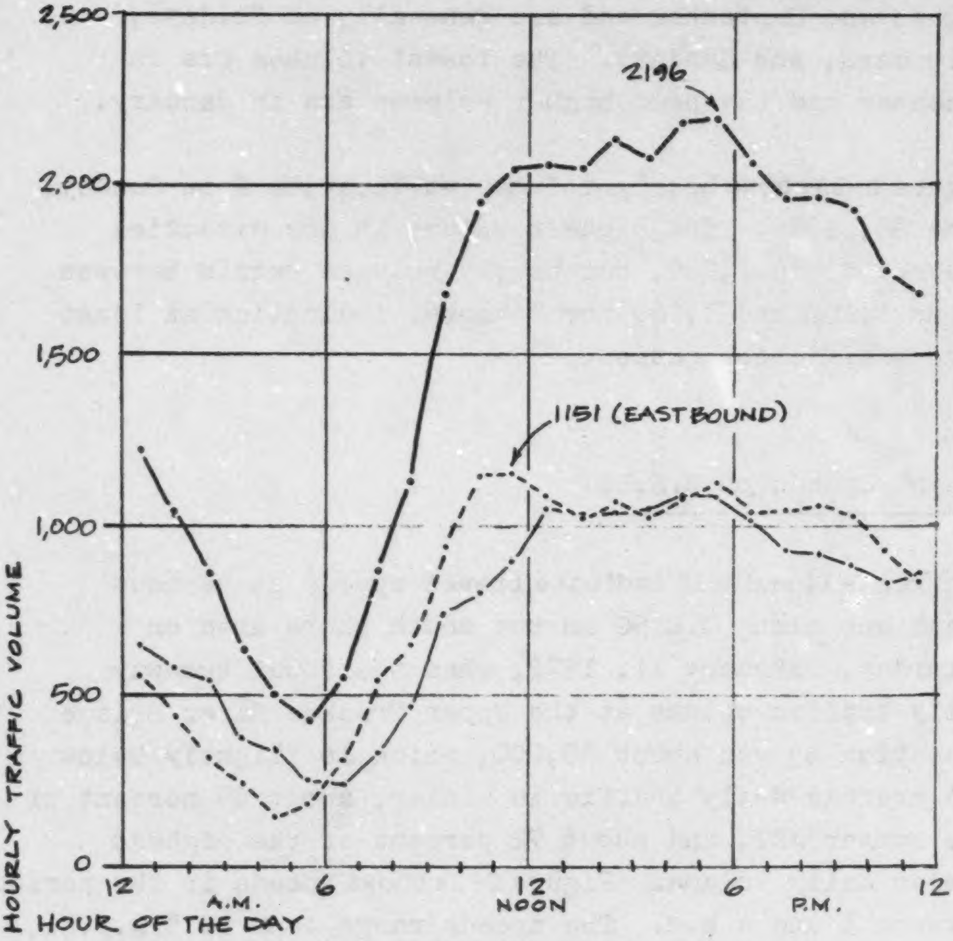


FIGURE D-20
HOURLY TRAFFIC COUNTS ON U.S. 50
BETWEEN HARRAHS AND HARVEYS -- LOCATION D
A SUMMER DAY (SATURDAY, JUNE 19, 1976)

SOURCE: NEVADA STATE HIGHWAY DEPT. COUNTS

shown in Figure D-21. The highest total two-way daily volume is 35,930 on Sunday, June 26, 1976. Average daily volumes by day of the week are shown for each month of 1977 in Figure D-22. The highest volumes are in July, August and September and are generally on Fridays, Saturdays, and Sundays. The lowest volumes are in December and the next higher volumes are in January.

Figure D-23 shows hourly volumes at location E on Sunday, June 26, 1976. The highest volume in one direction (eastbound) is 1,260, but hourly volumes remain between about 1,100 and 1,260 for 9 hours, indicating at least some traffic congestion.

Travel Speeds on U.S.50

Figures C-24 and C-25 indicate travel speeds at various locations along U.S.50 in the south shore area on Saturday, February 11, 1978, when the total two-way daily traffic volume at the Upper Truckee River Bridge (location B) was about 38,000, which is slightly below the average daily traffic in winter, about 85 percent of the summer ADT, and about 72 percent of the highest summer daily volume. Figure C-24 shows speeds in the period between 3 and 4 p.m. The speeds range down to 5 m.p.h., which occurs just west of Park Avenue for eastbound traffic. Figure C-25 is for the period between 4 and 6 p.m. when speeds are somewhat higher but some are still below 10 m.p.h. in the area between Park Avenue and Ski Run Boulevard. Lower speeds would be expected during the periods of heavier traffic on other days of the year.

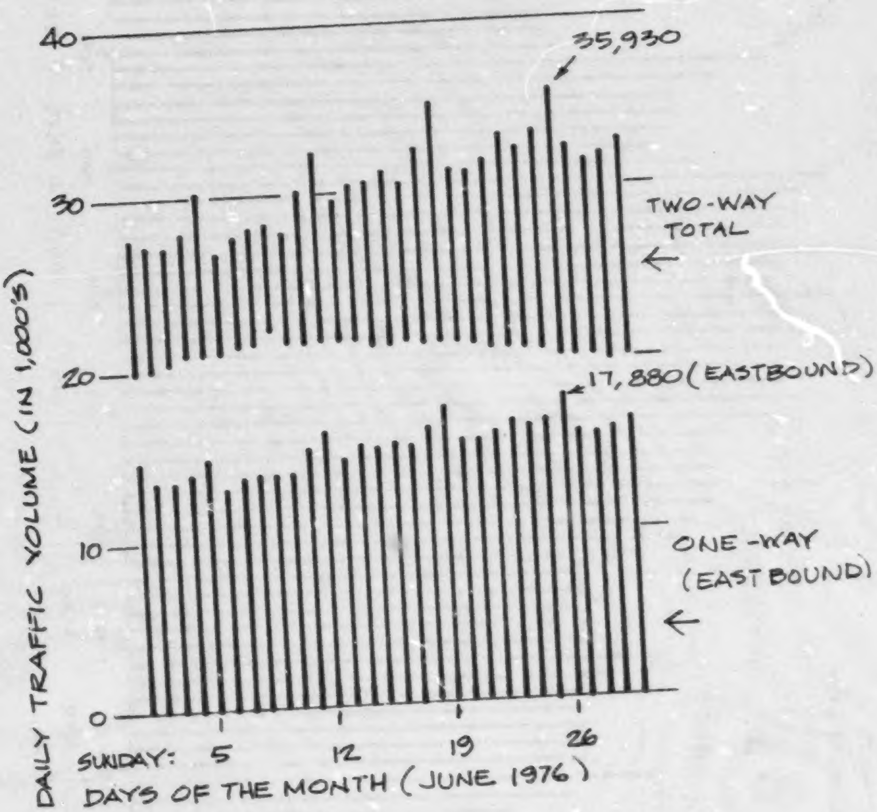
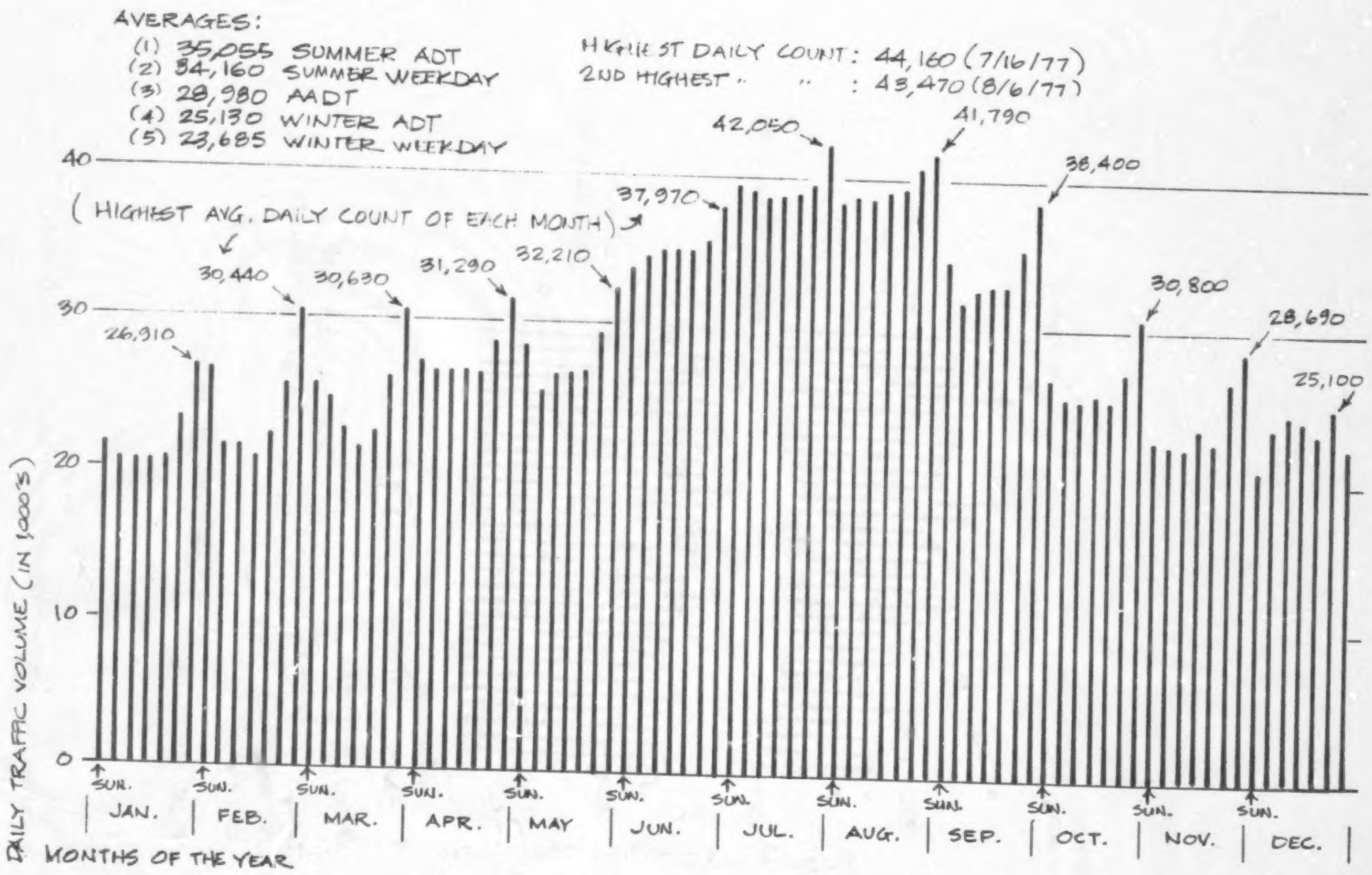


FIGURE D-21

DAILY TRAFFIC VOLUMES ON U.S. 50
AT WEST (SOUTH) SIDE OF KINGSBURY GRADE
LOCATION E

SUMMER MONTH OF JUNE, 1976

SOURCE: NEVADA STATE HIGHWAY DEPT. COUNTS



DAILY TRAFFIC VOLUMES ON U.S. 50
AT WEST (SOUTH) SIDE OF KINGSBURY GRADE -- LOCATION E

FIGURE D-22

AVERAGE VOLUME BY DAY OF THE WEEK FOR EACH MONTH OF YEAR 1977

SOURCE: NEVADA STATE HIGHWAY DEPT. COUNTS

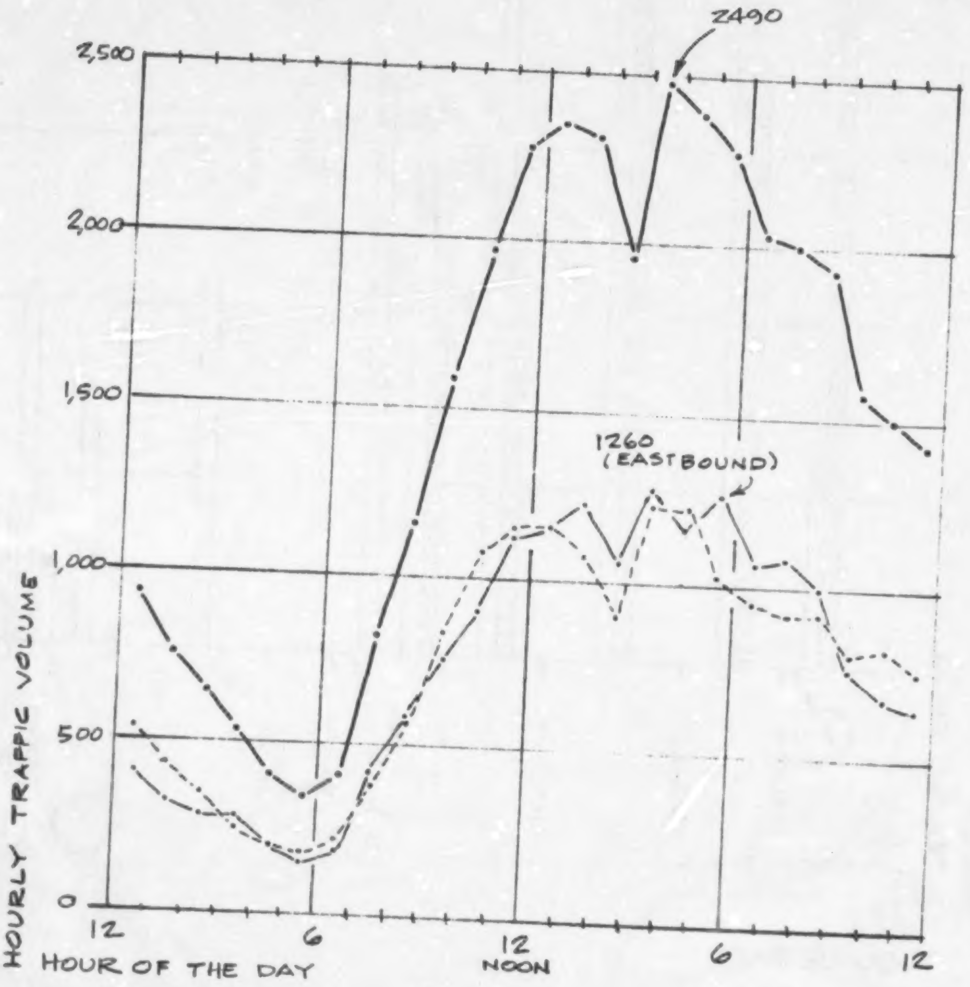


FIGURE D-23

HOURLY TRAFFIC COUNTS ON U.S. 50
AT WEST (SOUTH) SIDE OF KINGSBURY GRADE
LOCATION E

A PEAK SUMMER DAY (SUNDAY, JUNE 26, 1976)

SOURCE: NEVADA STATE HIGHWAY DEPT. COUNTS

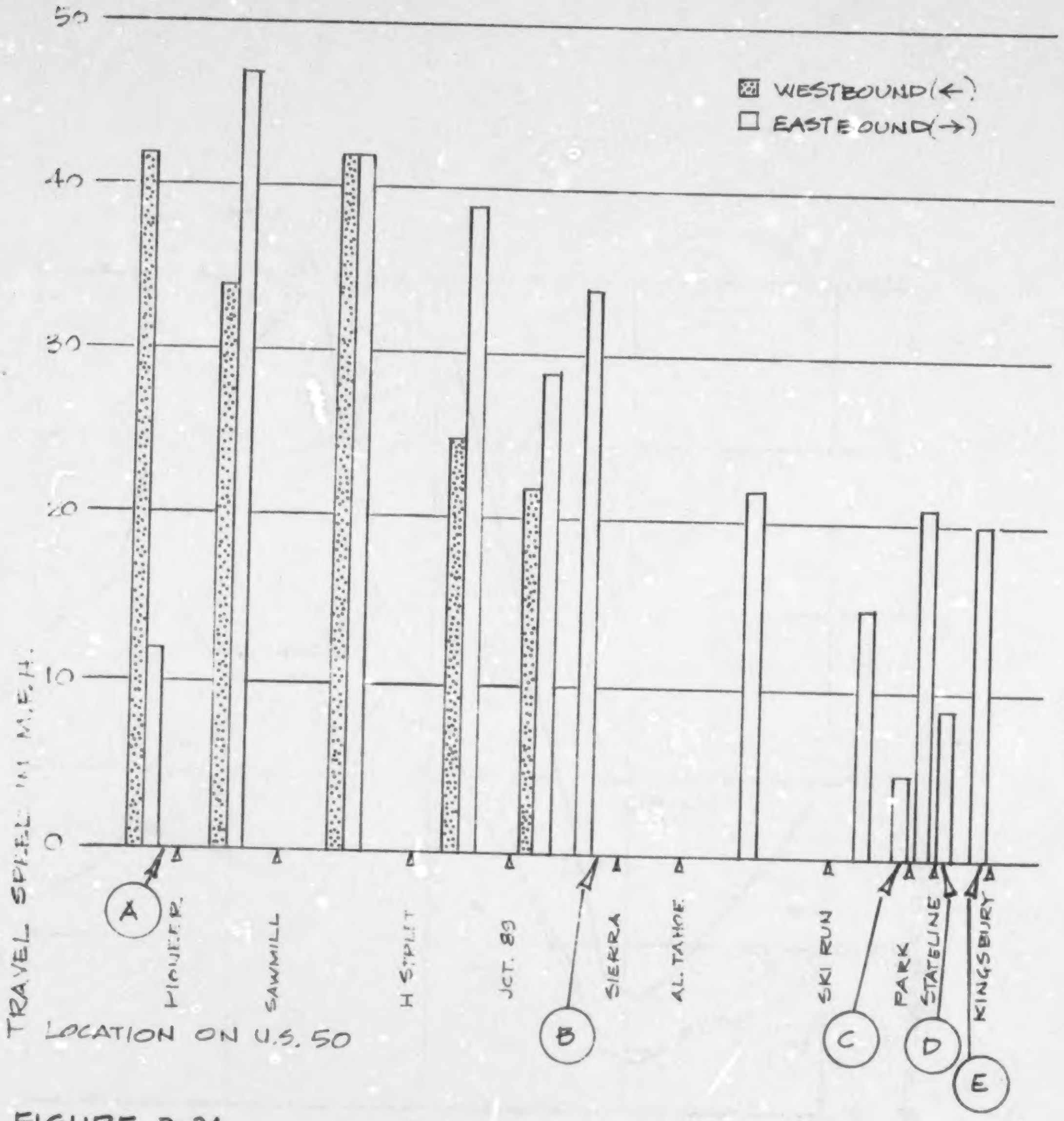


FIGURE D-24

TRAVEL SPEEDS ON U.S. 50
SATURDAY, FEBRUARY 11, 1978
BETWEEN 3 P.M. AND 4 P.M.

SOURCE: CTRPA

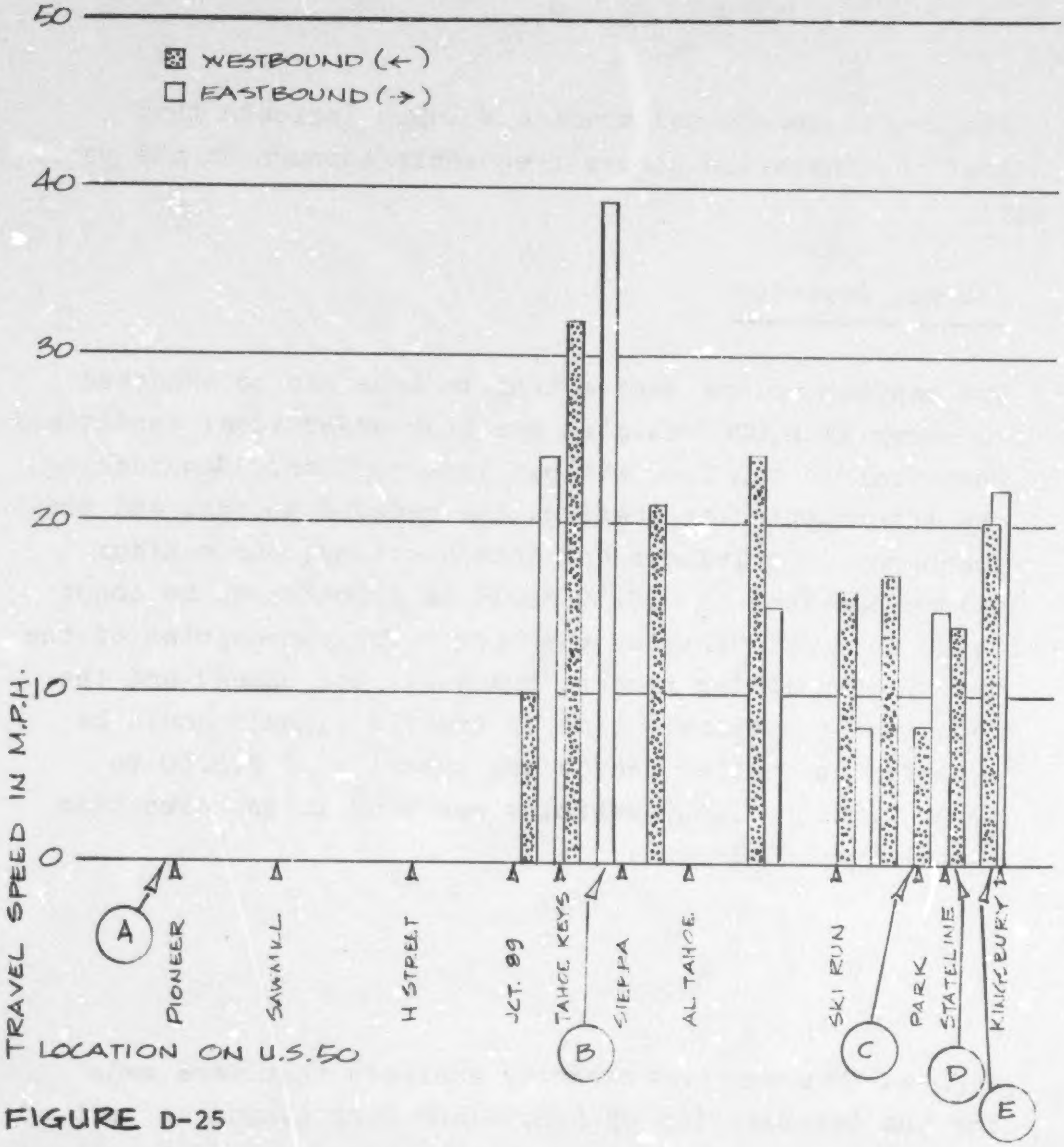


FIGURE D-25

TRAVEL SPEEDS ON U.S. 50
SATURDAY, FEBRUARY 11, 1978
BETWEEN 4 P.M. AND 6 P.M.

SOURCE: CTRPA

The travel speeds and traffic volumes indicate that traffic congestion occurs frequently throughout the year.

Traffic Capacity

The maximum volume that a traffic lane can be expected to carry is 2,000 vehicles per hour under ideal conditions when traffic can flow without interruption. Considering the interruption of traffic, the reduced speeds, and the frequency of driveways and intersections, the maximum volume per lane on U.S.50 could be expected to be about 1,400 to 1,500 vehicles per hour. The composition of the traffic (including trucks, tractors, and buses) and the metering of available time by traffic signals could be expected to further reduce the capacity of U.S.50 to about 1,200 to 1,400 vehicles per hour in one direction (total for two lanes).

Figure D-26 summarizes capacity analyses that were made for the intersection of U.S.50 and Park Avenue as part of a study for the City of South Lake Tahoe on the Loop Road that is proposed to go around the Stateline casinos. The analyses showed that the existing intersection was at or near capacity when it was carrying the traffic volumes that occurred between 3 and 4 p.m. on Saturday, March 18, 1978. Figures D-12 and D-22 which show counts at locations C and E, indicate that volumes at the U.S.50-Park Avenue

FIGURE D-26

CAPACITY ANALYSES OF U.S. 50/PARK AVE. INTERSECTION FOR VARIOUS COMBINATIONS OF ASSUMED CONDITIONS

CONDITIONS	SIGNAL PHASES VOLUME/SERVICE VOLUME RATIO G/C RATIO REQUIRED				TOTAL G/C REQUIRED, (SERVICE LEVEL)
(1) 1978 TRAFFIC. NO LOOP ROAD. EXISTING INTERSECTION.	(U.S. 50) 204/1000 0.20	(U.S. 50) 1168/2800 0.42	(PARK AVE) 581/1400 0.42		(D OR E) 1.16
(2) 1978 TRAFFIC, PLUS CASINO EXPANSION. NO LOOP ROAD. EXISTING INTERSECTION.	(U.S. 50) 264/1000 0.26	(U.S. 50) 1487/2800 0.53	(PARK AVE) 740/1400 0.53		(F) 1.44
(3) 1978 TRAFFIC, PLUS CASINO EXPANSION LOOP ROAD. EXISTING INTERSECTION.	(U.S. 50) 362/1000 0.36	(U.S. 50) 1249/2800 0.45	(PARK AVE) 800/1400 0.57		(F) 1.50
(4) 1978 TRAFFIC, PLUS CASINO EXPANSION. LOOP ROAD. PROPOSED INTERSECTION IMPROVEMENTS.	(U.S. 50) 362/1800 0.20	(U.S. 50) 1249/2400 0.52	(PARK AVE) 480/1800 0.27	(PARK AVE) 515/1800 0.09 (.29 - .20)	(E) 1.24

SOURCE: STATELINE AREA LOOP ROAD TRAFFIC STUDY, JUNE 1978,
BY BARTON-ASCHMAN ASSOCIATES AND WILLIAM F. PILLSBURY, INC.
FOR CITY OF SOUTH LAKE TAHOE, DEPT. OF PUBLIC WORKS

intersection are probably higher in about half the months of the year than in March. It is reasonable to assume that there are at least 8 days per month in 6 months of the year, or 48 to 50 days, that had higher traffic volumes than the day for which the capacity analysis was made. The hourly patterns indicate that hourly traffic remains at the peak level for 6 to 10 hours on the days of heavier traffic flow. Therefore, it would be reasonable to expect the capacity of the intersection to be exceeded during roughly 500 hours in the year. The other capacity analysis conditions summarized in Figure D-26 do not show any improvement of the operating conditions at the intersection, even with the completion of the loop road and widening, added lanes, channelization, and signal changes at the intersection.

Figure D-27 shows hourly rates of traffic flow at principal intersections on U.S.50 and Pioneer Trail. The hourly rates are expanded from 20-minute counts and are useful because they indicate the relative volumes of traffic on the cross streets at major intersections and on Pioneer Trail. The cross street volumes reduce the green signal time available for moving traffic on U.S.50. The volumes on Pioneer Trail indicate roughly the proportion of traffic that it may be possible to divert from U.S.50. The indications are (1) that green time available at signalized intersections for traffic on U.S.50 would be about 50 percent of the total signal time, and (2) that about 25 percent of the traffic from U.S.50 turns onto Pioneer Trail at each end of Pioneer Trail (at Meyers and Stateline).

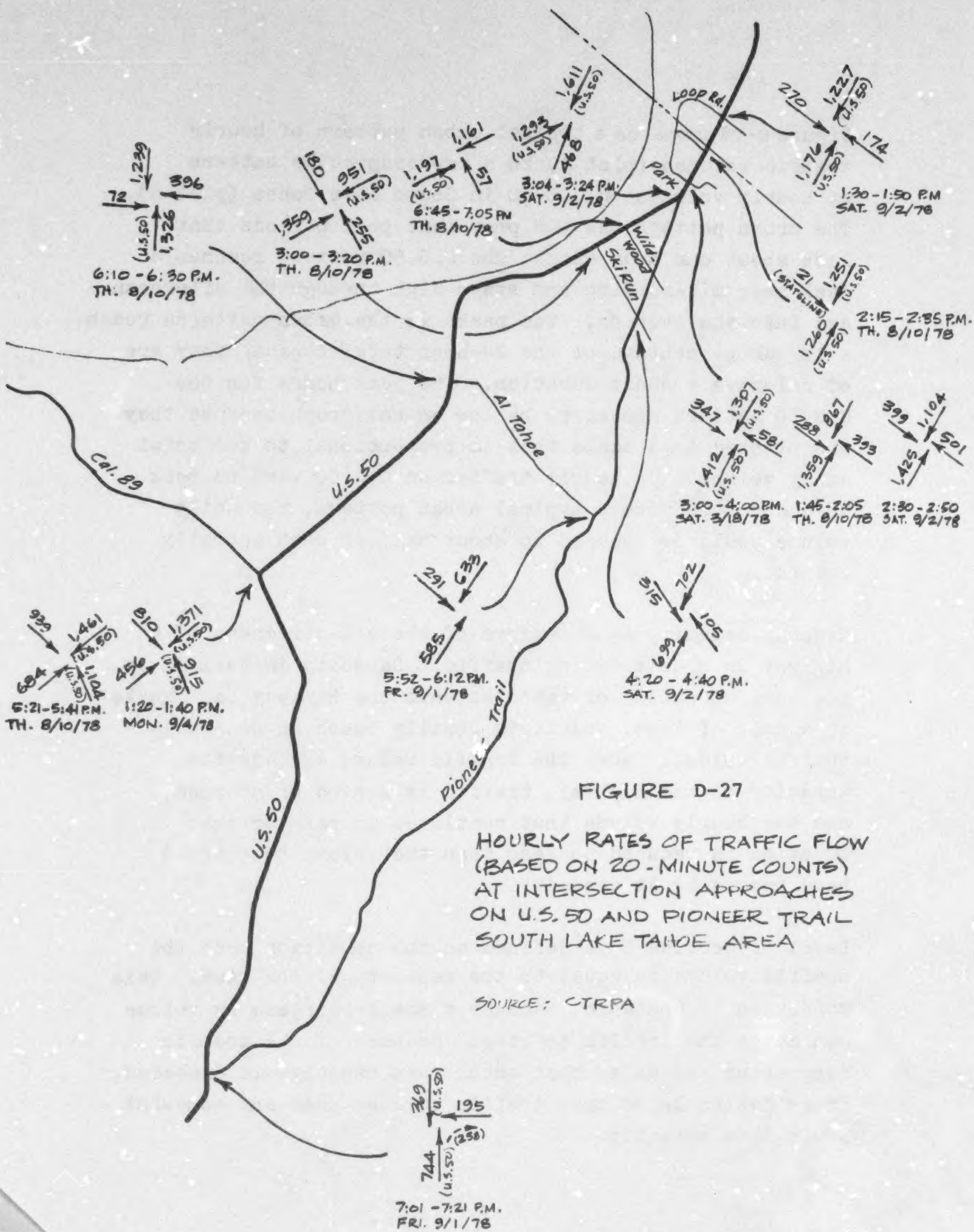


FIGURE D-27

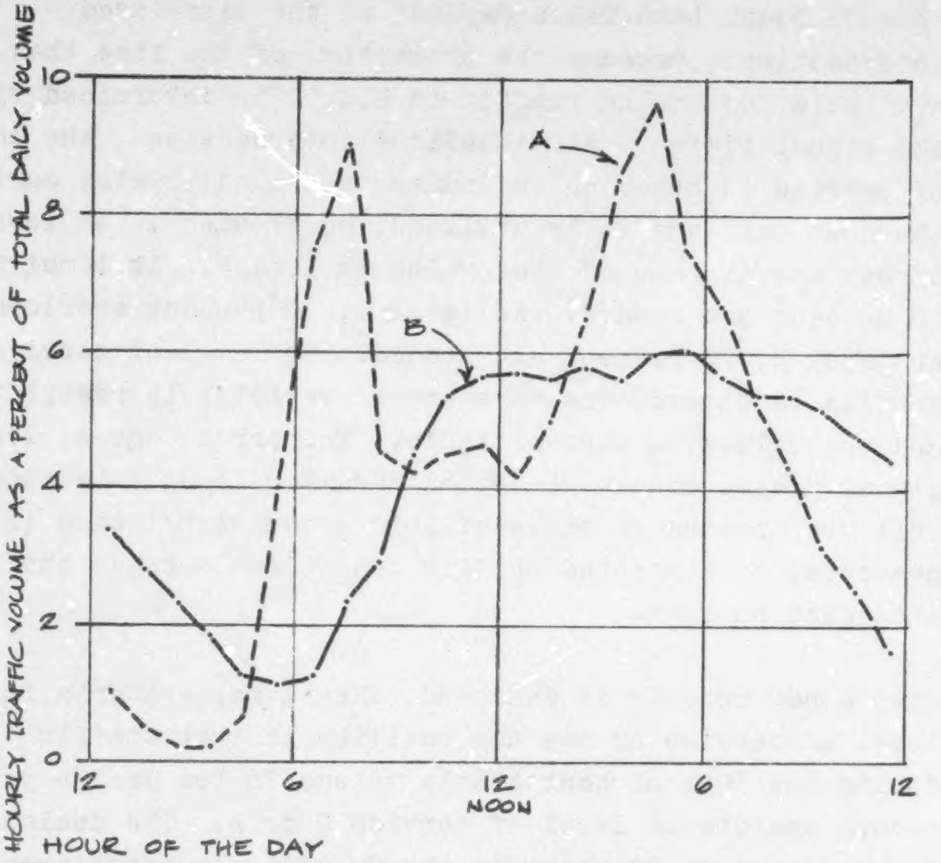
HOURLY RATES OF TRAFFIC FLOW (BASED ON 20-MINUTE COUNTS) AT INTERSECTION APPROACHES ON U.S. 50 AND PIONEER TRAIL SOUTH LAKE TAHOE AREA

SOURCE: CTRPA

Figure D-28 compares a typical urban pattern of hourly traffic volumes (plot A) to a representative pattern of hourly volumes on U.S.50 in South Lake Tahoe (plot B). The urban pattern has two prominent peak periods that last about one hour each. The U.S.50 pattern reaches a peak near mid-morning and stays high through the afternoon and into the evening. The peaks in the urban patterns reach a larger percentage of the 24-hour total because they are of relatively short duration. The peak hours for the U.S.50 pattern appear to be low on the graph because they are plotted to a scale that is proportional to the total daily volume. If hourly traffic on U.S.50 were to peak in accordance with a typical urban pattern, the daily volume would be reduced to about half of what actually occurs.

Highway capacity is a measure of the effectiveness of a highway in accommodating traffic. Capacity is defined as the maximum number of vehicles that the highway can handle in a unit of time, and it is usually based on an hourly traffic volume. When the traffic volume exceeds the capacity of the highway, traffic is slowed or stopped, and the hourly volume that continues to pass by that location is reduced to less than the volume that could have passed by at capacity.

Level of service E is defined as the condition when the traffic volume is equal to the capacity of the road. This condition is unstable, because a small increase in volume can cause the traffic to stop. Because of the traffic congestion and delay that occur when capacity is exceeded, it is desirable to have traffic volumes that are somewhat lower than capacity.



A : TYPICAL PATTERN FOR URBAN AREA
B : REPRESENTATIVE PATTERN FOR U.S. 50, SOUTH LAKE TAHOE

FIGURE D-28
COMPARISON OF HOURLY TRAFFIC PATTERNS
FOR URBAN AREA AND SOUTH LAKE TAHOE

Levels of service A through D are conditions in which traffic is less than capacity. The capacity of U.S.50 through South Lake Tahoe depends on the signalized intersections, because the proportion of the time that is available for moving traffic on U.S.50 is determined by the signal timing. At signalized intersections, the level of service is based on the number of signal cycles during the hour that are fully utilized, or "loaded". At level of service A, none of the cycles is loaded. At level B, 10 percent are loaded. At level C, 30 percent are loaded. At level D, 70 percent are loaded. At level of service F, traffic is jammed, the movement of vehicles is restricted, and the volume is unpredictable. The percentage of loaded signal cycles cannot be established for level F because full utilization of the available green signal time is prevented by congested traffic conditions outside the intersection area.

When a new roadway is designed, the normal criteria for level of service on the new facility is that traffic during the 30th highest hourly volume in the design year should operate at level of service C or D. The design year is usually 20 years in the future. In urban areas, level of service D is normally considered acceptable for the design-hour traffic. When the 30th highest hour of the year operates at level of service D, the highest hour of the year can be expected to operate near capacity. Therefore, under normal criteria for urban areas there would be only a few hours of the year when traffic volumes would exceed capacity.

On U.S.50 in South Lake Tahoe, capacity is probably exceeded for extended periods of time on at least 50 days of the year, and for shorter periods on other days. It is likely that capacity is exceeded during substantially more than 500 hours of the year.

Travel Patterns

Origin-destination surveys of summer and winter travel in the Lake Tahoe basin were conducted in 1974. Average daily vehicle trips between sectors of the basin, and between sectors and cordon stations (the seven basin entry points), are listed in Table D-8 for an average summer weekday in 1974, and in Table D-9 for an average winter weekday in 1974.

Locations of the stations and sectors are indicated in Figure D-29. The boundaries and numbers of major traffic zones are also shown in Figure D-29. Major zones 01 through 14, and 30 through 32 are in Sector A, which includes most of the south shore area. Routes through cordon stations 3, 4, and 5 enter the basin in Sector A. Figure D-30 shows the boundaries of the major traffic zones more clearly.

Figure D-31 shows the locations of principal roads and highways in the basin relative to the major traffic zones and cordon stations.

Table D-8 lists 252,030 vehicle trips daily for an average summer weekday in 1974, and Table D-9 lists 120,730 for an

TABLE D-8- AVERAGE DAILY VEHICLE TRIPS . SUMMER 1974

	STATIONS						SECTORS							ROW TOTAL	ROW & COLUMN TOTAL	
	2	3	4	5	6	7	A	B	C	D	E	F	G			
1	-	-	-	-	20	40	220	-	150	430	890	240	20	2010	2010	1
2	-	280	30	510	70	90	3850	120	310	240	400	70	490	6460	6460	2
3		-	10	80	20	-	1320	70	30	20	20	-	30	1600	1680	3
4			-	570	110	-	1480	150	40	30	60	-	20	2460	2500	4
5				-	650	-	9370	1120	330	60	180	-	210	11,920	13,080	5
6					-	300	500	310	4670	1180	260	50	40	7310	8180	6
7						-	290	20	200	2320	1290	20	60	4200	4630	7
A							126,200	4980	2210	730	1580	50	4990	140,740	157,770	A
B								1030	650	190	110	40	40	2060	8830	B
C									27,860	8750	1680	160	100	38,550	47,140	C
D										11,700	6980	150	20	18,850	32,800	D
E											14,070	410	140	14,620	28,070	E
F												10	40	50	1240	F
G													1200	1200	7400	G
														252,030	321,990	

TABLE D-9 · AVERAGE DAILY YEHICLE TRIPS · WINTER 1974

	STATIONS						SECTORS							ROW TOTAL	ROW & COLUMN TOTAL	
	2	3	4	5	6	7	A	B	C	D	E	F	G			
1	60	-	-	10	10	40	100	-	90	180	830	10	-	1330	1330	1
2	-	130	-	140	10	50	2660	10	90	160	310	60	360	3980	4040	2
3		-	30	20	-	-	1090	-	10	-	10	-	50	1210	1340	3
4			-	160	-	-	890	-	20	-	10	-	10	1090	1120	4
5				-	180	-	5320	10	100	40	40	-	60	5750	6080	5
6					-	110	290	10	3430	850	170	-	-	4860	5060	6
7						-	150	-	160	1910	820	-	20	3060	3260	7
A							61,370	320	710	450	490	30	2050	65,420	75,920	A
B								10	60	10	10	-	-	90	440	B
C									12,600	4500	770	-	20	17,890	22,560	C
D										6000	3000	-	10	9010	17,110	D
E											6620	30	40	6690	13,150	E
F												10	10	20	150	F
G													330	330	2960	G
														120,730	154,520	

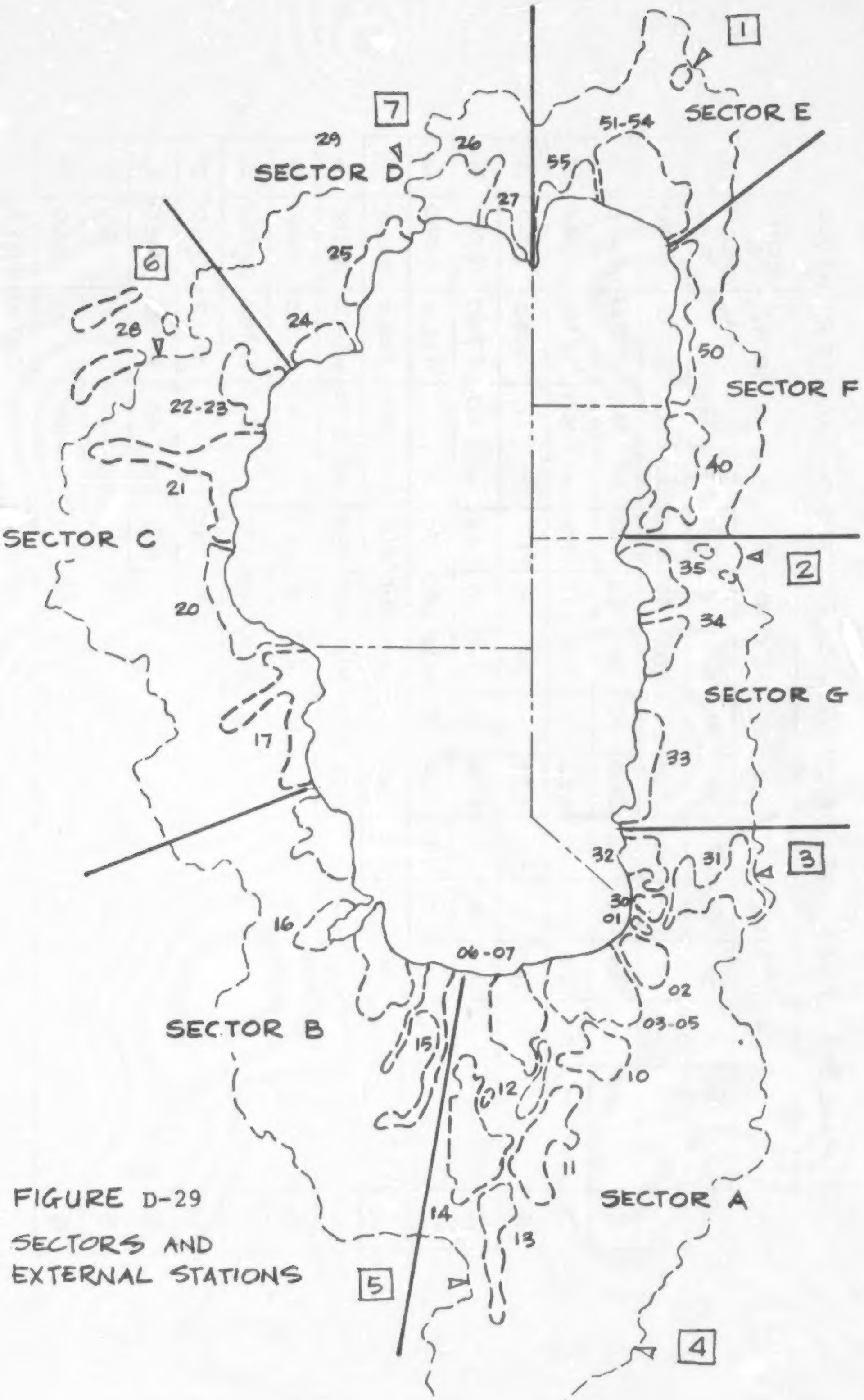


FIGURE D-29
SECTORS AND
EXTERNAL STATIONS

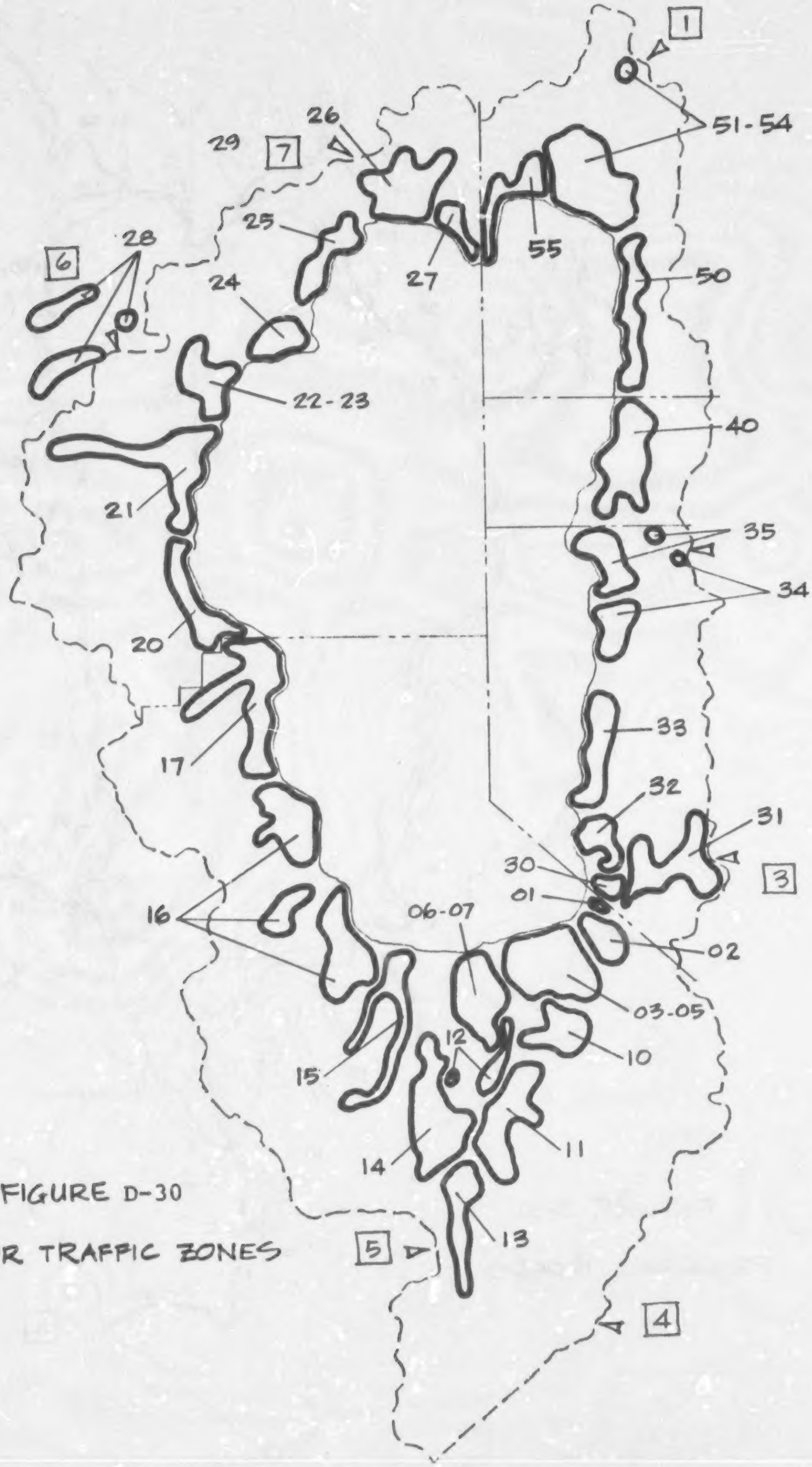


FIGURE D-30

MAJOR TRAFFIC ZONES

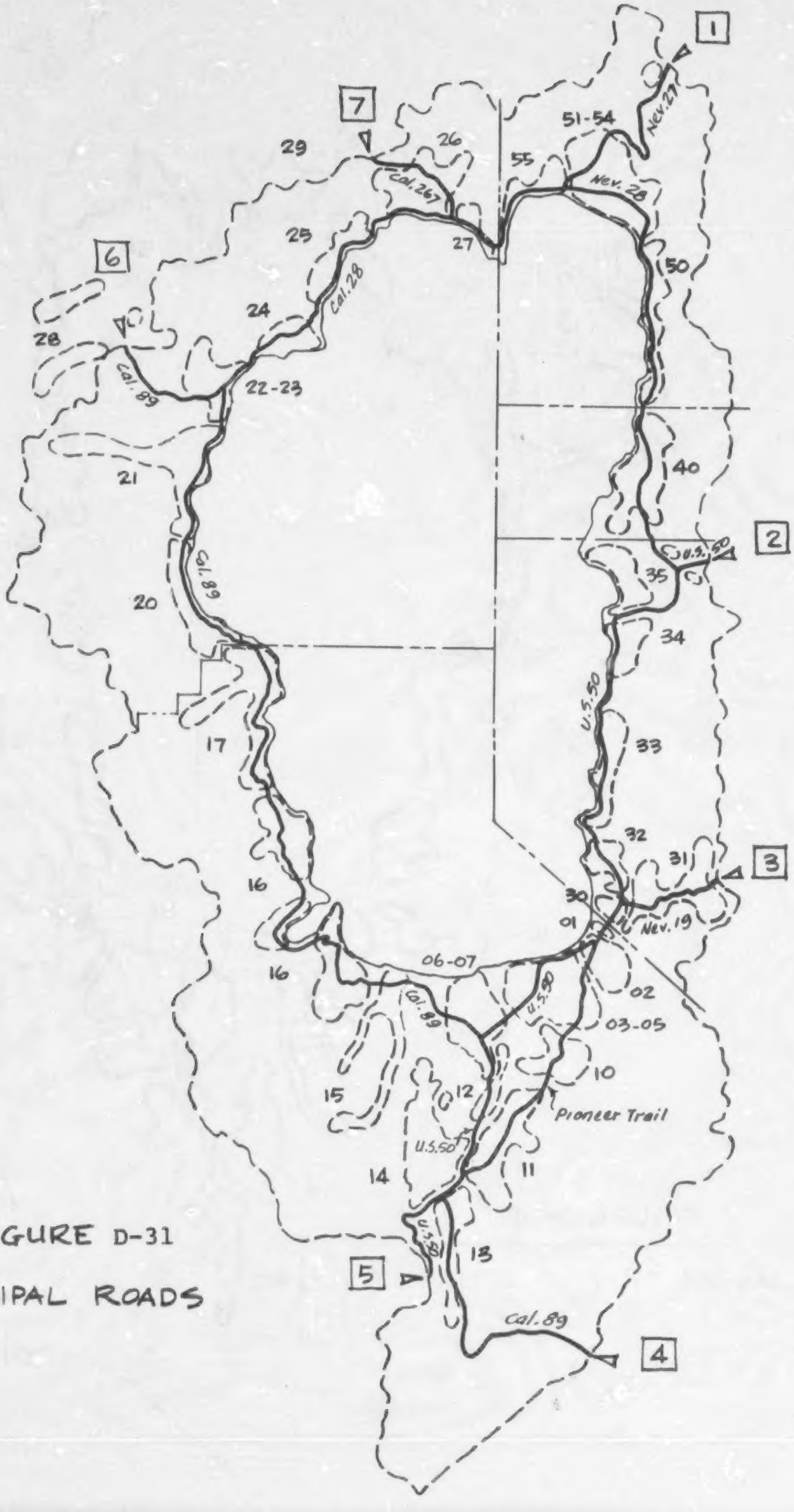


FIGURE D-31

PRINCIPAL ROADS

average winter weekday. Figure D-32 indicates how many of the trips occurred within each sector and through each station. The figure clearly illustrates that Sector A has more traffic than any other area within the basin.

Figure D-33 shows the volume and percentage distribution of trips to, from and within Sector A for an average summer day. Only 3 percent of the trips are through trips -- trips passing through the sector without making a notable stop. About 77 percent of the trips are local trips that stay within the sector. The remaining 20 percent are trips to or from Sector A.

Breakdowns of the 1974 trips by major traffic zone within Sector A are listed in Tables D-10 and D-11. The trips in Table D-10 indicate 42,000 vehicles daily crossing the state line, of which 4.6 percent are through trips that would pass through Sector A without stopping, and 9.7 percent are between Echo Summit (Station 5) and the Stateline casino area.

When the survey data were tested against screenline counts it was found that the trips were apparently underreported by about 20 to 30 percent. The trips were adjusted by Caltrans staff to make up the difference before future traffic projections and assignments were prepared.

The average weekday trips from the 1974 O-D survey - are not necessarily representative of the proportions

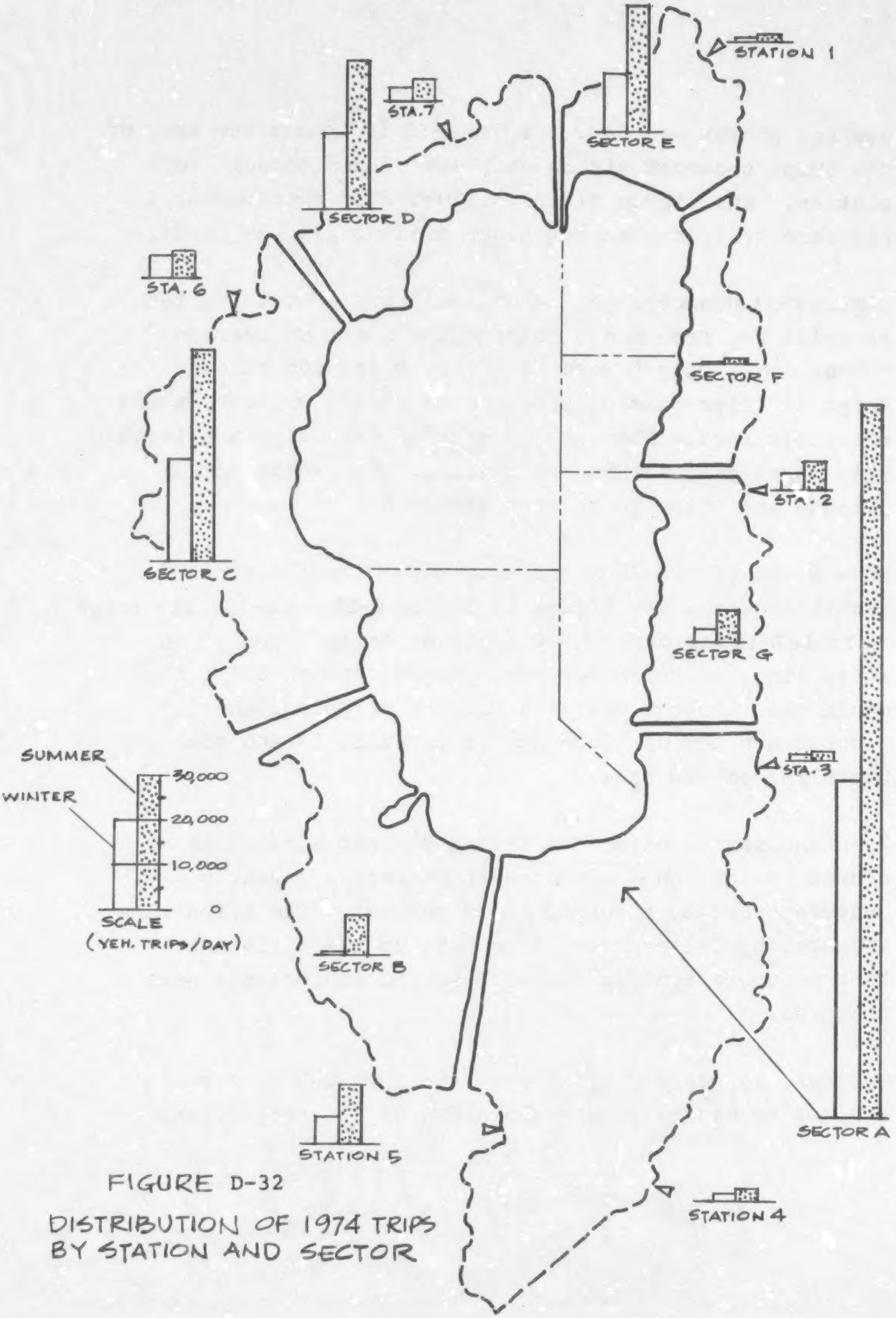


FIGURE D-32

DISTRIBUTION OF 1974 TRIPS BY STATION AND SECTOR

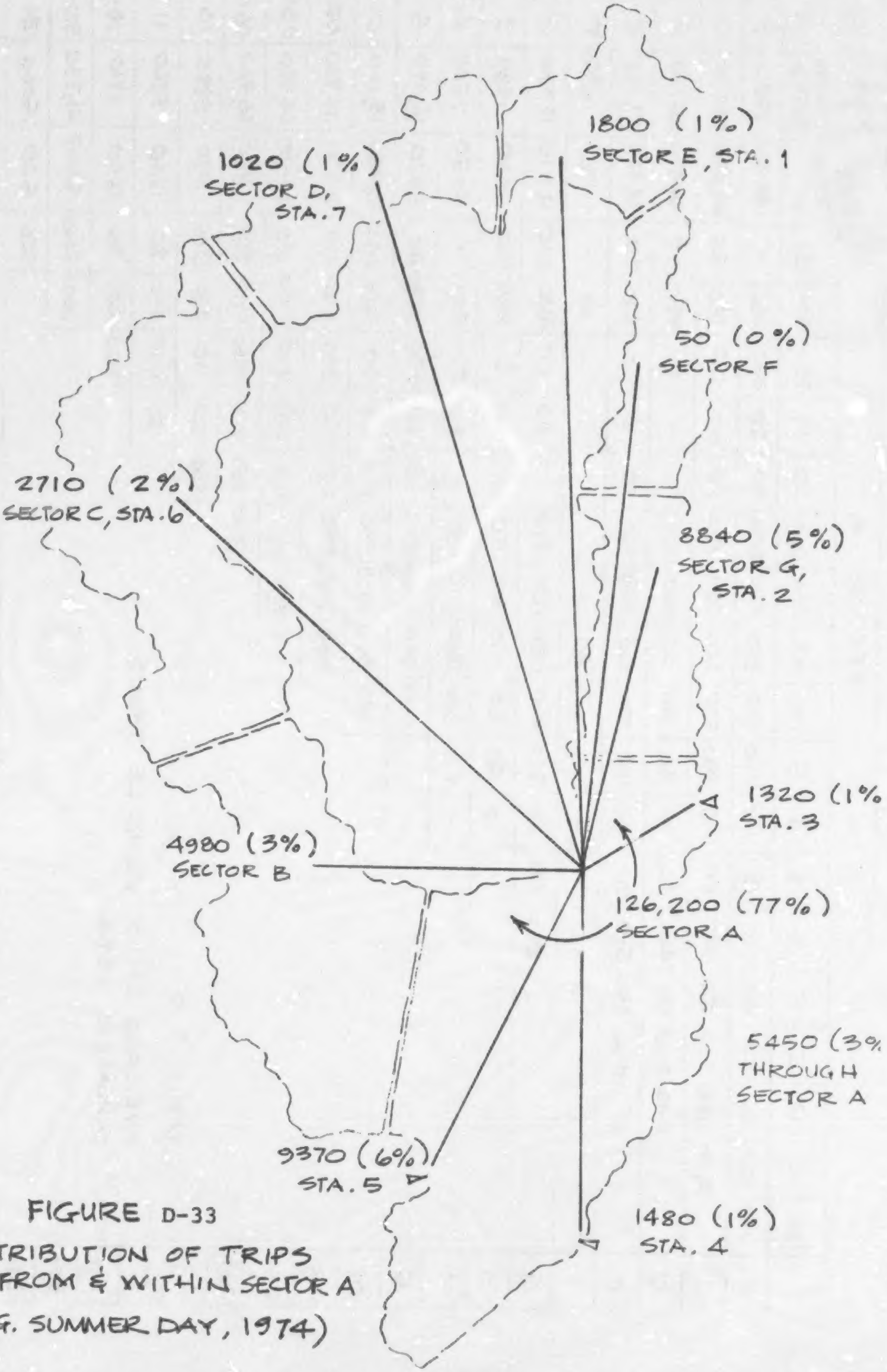


FIGURE D-33
DISTRIBUTION OF TRIPS
TO, FROM & WITHIN SECTOR A
(AVG. SUMMER DAY, 1974)

							SECTOR A												ROW TOTAL	ROW & COLUMN TOTAL	
	B	C	D	E	F	G	3	4	5	01	02	03+	06+	10	11	13+	30+	31			
B	1030	960	210	110	40	160	70	150	1120	410	350	960	2170	40	80	340	630	-	8830	8830	B
C		32,530	10,430	2110	210	520	50	150	980	220	220	520	770	10	40	120	790	20	49,690	50,650	C
D			14,020	8740	170	410	20	30	60	60	20	160	270	-	-	10	490	10	24,470	35,110	D
E				14,960	650	560	20	60	180	120	110	440	150	30	10	40	870	30	18,230	29,190	E
F					10	110	-	-	-	-	40	-	-	-	-	-	10	-	170	1240	F
G						1690	310	50	720	660	1070	1210	880	10	90	60	4550	310	11,610	13,370	G
3							-	10	80	60	330	300	50	-	-	-	380	200	1410	1880	3
4								-	570	100	200	270	430	-	30	250	200	-	2050	2500	4
5									-	1150	780	1540	1240	60	60	530	3970	40	9370	13,080	5
01										540	2170	2320	990	110	60	90	3860	240	10,380	13,160	01
02											3040	7980	3250	240	120	370	6120	410	21,530	26,820	02
03+												19,150	14,300	1640	990	1820	10,480	670	49,050	64,750	03+
06+													22,100	850	1120	3460	4510	380	32,420	56,920	06+
10														230	20	110	440	90	890	3880	10
11															50	680	490	20	1240	3260	11
13+																1150	600	80	1830	9710	13+
30+																	6300	2040	8340	46,730	30+
31																		520	520	5060	31
																			252,030	386,740	

TABLE D-10

AVERAGE DAILY VEHICLE TRIPS
SUMMER 1974

							SECTOR A													
	B	C	D	E	F	G	3	4	5	01	02	03+	06+	10	11	13+	30+	31	ROW TOTAL	ROW & COLUMN TOTAL	
B	10	70	10	10	-	10	-	-	10	30	10	70	140	10	-	10	50	-	440	440	B
C		16,030	5620	1040	-	120	10	20	280	120	140	230	210	110	-	30	250	10	24,120	24,190	C
D			7910	4040	-	240	-	-	40	30	90	130	110	-	10	30	190	10	12,830	18,460	D
E				7450	40	410	10	10	50	40	80	110	40	-	-	10	290	20	8560	13,650	E
F					10	70	-	-	-	-	20	-	-	-	-	-	10	-	110	150	F
G						690	180	10	200	200	390	680	630	30	20	130	2240	390	5790	6640	G
3							-	30	20	50	90	170	160	10	-	20	390	200	1140	1340	3
4								-	160	60	100	190	240	10	20	160	100	10	1050	1120	4
5									-	630	790	1080	880	60	120	390	1320	50	5320	6080	5
01										350	1330	1020	570	80	30	100	1820	90	5390	6550	01
02											2370	4650	2000	200	30	260	3030	280	12,820	15,860	02
03+												9780	7330	640	300	880	4810	370	24,110	32,440	03+
06+													9350	440	220	1110	2010	210	13,340	25,650	06+
10														80	-	10	230	20	340	1930	10
11															180	200	120	-	500	1250	11
13+																480	270	20	770	410	13+
30+																	2490	1230	3720	20,850	30+
31																		380	380	3290	31
																			120,730	183,900	

TABLE D-11

AVERAGE DAILY VEHICLE TRIPS
WINTER 1974

of resident and vacation trips in peak-day traffic. Although resident trips can probably be predicted with some confidence in relation to potential population growth, trips by visitors who reside outside the basin are generated only partly by conditions within the basin, and cannot be predicted with certainty on the basis of conditions within the basin alone.

Factoring to Year-2000 Traffic Volumes

Caltrans prepared traffic projections and assignments for 1995 by computer model. The assignment process allocated a future traffic volume to each segment (link) of the principal road network. Two assignments were made available for the TREES analyses -- a 1995 High and a 1995 Low projection. The populations and employment data on which the two projections were based are listed in Tables D-12 and D-13.

Population and employment assumptions for the five TREES growth scenarios are listed in Tables D-14, D-15, and D-16. Table D-14 is for an average summer day. Table D-14 is for a peak summer day. Table D-16 employment would apply to a peak day. It was determined that Scenario 2 for the year 2000 and the Caltrans 1995 Low projection were almost the same. The resident population in both cases is approximately 47,000. The employment data appear to be different, but the definitions of gaming, service and retail employment are different in the two data listings.

TABLE D-12

Summary of Population and Employment Data
Used in Caltrans 1995 (HIGH) Traffic Assignment

Average Summer Day Population and Employment

Sector	Sector Population			Sector Employment		
	Residents	Visitors	Total	Gaming	Other	Total
A	46,906	51,542	98,448	26,434	13,749	40,183
B	293	4,909	5,202	o	46	46
C	8,767	16,019	24,786	o	4,395	4,395
D	7,964	9,637	17,601	o	2,954	2,954
E	18,128	13,680	31,808	12,107	7,212	4,895
F	151	1,376	1,527	o	38	38
G	3,403	5,476	8,879	o	805	805
Region Total	85,612	102,639	188,251	38,541	29,199	53,316

Source: Caltrans computer tabulation

TABLE D-13

Summary of Population and Employment Data
Used in Caltrans 1995 (LOW) Traffic Assignment

Average Summer Day Population and Employment

Sector	Sector Population			Sector Employment		
	Residents	Visitors	Total	Gaming	Other	Total
A	44,976	51,170	96,146	20,451	12,919	33,370
B	293	4,909	5,202	o	46	46
C	8,767	16,019	24,786	o	4,051	4,051
D	7,964	9,637	17,601	o	2,883	2,883
E	11,918	9,233	21,151	6,000	3,092	9,092
F	102	924	1,026	o	25	25
G	2,351	3,333	5,684	o	519	519
Region Total	76,371	95,225	171,596	26,451	23,535	49,986

Source: Caltrans computer tabulation

TABLE D-14

TREES Growth Scenario Populations (South Shore)

	Average Summer Day Population				
	Residents	Visitors			
Year		Overnight Visitors	Day Visitors	Total	Total Population
Existing Conditions:					
1978	34,850	48,210	35,190	83,400	118,250
Scenario 1:					
1990	39,280	62,050	45,290	107,340	146,620
2000	39,280	62,670	48,790	111,460	150,740
Scenario 2:					
1990	44,390	75,960	55,450	131,410	175,800
2000	47,560	83,710	61,110	144,820	192,380
Scenario 3:					
1990	49,090	75,140	54,850	129,990	179,080
2000	51,280	83,590	61,020	144,610	195,890
Scenario 4:					
1990	46,290	76,911	56,140	133,051	179,341
2000	49,540	91,711	66,940	158,651	208,191
Scenario 5:					
1990	50,670	80,690	58,900	139,590	190,260
2000	59,270	104,930	76,600	181,530	240,800

Source: Recht, Hausrath & Associates

TABLE D-15

TREES Growth Scenario Populations (South Shore)

	Summer Peak Day Population				
	Residents	Visitors			
Year		Overnight Visitors	Day Visitors	Total	Total Population
Existing Conditions:					
1978	34,850	75,590	55,180	130,770	165,620
Scenario 1:					
1990	39,280	93,630	68,350	161,980	201,260
2000	39,280	94,280	72,950	167,230	206,510
Scenario 2:					
1990	44,390	112,580	82,180	194,760	239,150
2000	47,560	123,120	89,870	212,990	260,550
Scenario 3:					
1990	49,090	112,970	82,470	195,440	244,530
2000	51,280	123,970	90,500	214,470	265,750
Scenario 4:					
1990	46,290	113,980	83,200	197,180	243,470
2000	49,540	132,190	96,490	228,680	278,220
Scenario 5:					
1990	50,670	120,570	88,020	208,590	259,260
2000	59,270	152,900	111,620	264,520	323,790

Source: Recht, Hausrath & Associates

TABLE D-16

TREES Growth Scenario Employment Data

Year	South Shore Summer Employment		
	Gaming Employment	Other Employment	Total
Existing Conditions			
1978	9,360	12,259	21,619
Scenario 1:			
1990	9,880	15,162	25,042
2000	9,880	15,162	25,042
Scenario 2:			
1990	9,880	16,040	25,920
2000	9,880	17,651	27,531
Scenario 3:			
1990	12,480	17,226	29,706
2000	12,480	18,758	31,238
Scenario 4:			
1990	12,480	17,202	29,682
2000	15,600	20,237	35,837
Scenario 5:			
1990	12,480	18,445	30,925
2000	15,600	22,404	38,004

Source: Recht, Hausrath & Associates

Ratios of year-2000 residents and employment for the growth scenarios are listed in Table D-17. The factors compare the scenarios, using Scenario 2 as a base. Residents and total employment were considered more reliable for comparison than the other categories, and a factor was selected for each scenario, based on the ratios for residents and total employment. The purpose of the selected factors is to adjust average summer traffic volumes from Scenario 2 to represent volumes for the other scenarios. Because the factors are for average weekdays, the resident ratios were given more weight than the employment ratios. In addition, it was considered that traffic conditions in Scenario 5 would be more constrained by road capacity because of higher growth.

Table D-18 lists estimated ratios of summer and winter peak day traffic volume to average summer weekday traffic for each sector. The estimated ratios for winter peak days are partly based on ratios of peak month to annual average daily volumes and availability of facilities for skiing in each sector.

Table D-19 lists the adjustment factors that were used to calculate year-2000 volumes from the Caltrans 1995 (Low) traffic assignment. The factors in part A of the table were used to obtain year-2000 average summer day traffic for Sector A. Factors in part B were then applied to obtain year-2000 summer and winter peak day traffic volumes.

TABLE D-17

Comparative Factors for Year-2000 Growth Scenarios Based on Scenario 2 Population and Employment For Average Summer Day (South Shore)

Comparison Item and Factor	Growth Scenario: 1	2	3	4	5
Residents	39,300	47,600	51,300	49,500	59,300
Factor	.83	1.00	1.08	1.04	1.25
Visitors	111,460	144,820	144,610	158,651	181,530
Factor	.77	1.00	1.00	1.10	1.25
Total Population	150,740	192,380	195,890	208,191	240,800
Factor	.78	1.00	1.02	1.08	1.25
Gaming Employment	9,880	9,880	12,480	15,600	15,600
Factor	1.00	1.00	1.26	1.58	1.58
Other Employment	15,162	17,651	18,758	20,237	22,404
Factor	.86	1.00	1.06	1.15	1.27
Total Employment	25,042	27,531	31,238	35,837	38,004
Factor	.91	1.00	1.13	1.30	1.38
Selected Factors	.86	1.00	1.10	1.05	1.19

TABLE D-18

Estimated Ratio by Sector
Of Summer and Winter Peak Day Traffic
to Average Summer Day Traffic

Sector	Range of Ratios, Pk.Mo. to AADT*	Estimated Ratios of Traffic, Peak Day to Avg. Summer Day	
		Summer Peak	Winter Peak
A	1.2-1.4	1.20	1.10
B	1.8-2.0	1.35	0.80
C	1.4	1.25	1.20
D	1.65	1.30	1.05
E	-	1.20	1.10
F	1.4	1.15	0.90
G	1.4-1.55	1.30	1.10

* Annual Average Daily Traffic Volume

Sources of peak month to AADT ratios:
Caltrans 1977 traffic volume report,
Nevada State Highway Department traffic counts

TABLE D-19

Factors to Convert Caltrans 1995 (Low) Link Assignments to Year-2000 Traffic Volumes

A. Factors for Growth Scenarios (Sector A only)

Multiply factor times 1995 average summer day traffic to give year-2000 average summer day traffic

Scenario:	1	2	3	4	5
Factor:	0.90	1.05	1.15	1.10	1.25

B. Factors for Peak Summer and Winter Days

Multiply factor times year-2000 average summer day traffic to give year-2000 peak summer or winter day traffic.

Sector	Summer Peak Day Factor	Winter Peak Day Factor
A	1.15	1.05
B	1.35	0.80
C	1.25	1.20
D	1.25	1.15
E	1.15	1.05
F	1.15	0.90
G	1.25	1.05

Assignment Network

The Caltrans 1995 assignment assumed the existing road network plus only the completion of the Loop Road around the casinos in the south shore Stateline area, and a short bypass of the commercial district at Tahoe City. These assumptions are therefore implicit in the traffic volumes derived from the Caltrans assignment.

Transit Assumptions

The Caltrans 1995 assignment also assumed major transit improvements in the south shore area, including light rail service on U.S.50 through South Lake Tahoe. The number of transit riders attracted from automobiles was modelled by Caltrans on a computer and the result was a reduction of approximately 10 percent in the total traffic volume in the U.S.50 corridor. The assigned traffic volumes were increased in the TREES analyses to remove the effects of the transit improvements for the basic year-2000 conditions.

MITIGATION MEASURES

Reports for the U.S. Environmental Protection Agency and U.S. Department of Transportation have identified reasonably available transportation control measures (RACM) that could be expected to reduce vehicle miles travelled (VMT) and vehicle emissions. Some of these measures, including the following, would also be expected to reduce traffic volumes;

- Improved public transit
- Exclusive bus and carpool lanes
- Area wide carpool programs
- Private car restrictions
- Long-range transit improvements
- On-street parking controls
- Park-and-ride fringe parking lots
- Pedestrian malls
- Employer programs to encourage car pooling, vanpooling, transit, bicycling and walking
- Bicycle lanes and storage facilities
- Staggered work hours
- Road pricing to discourage single occupancy auto trips

Data available from analyses of applications of these individual measures, in specific urban areas indicate that none of them is likely to produce reductions of more than 5 percent, and most would produce substantially less than 5 percent. Effectiveness of these measures in the Lake Tahoe Basin would be even less because of the large percentage of visitors from outside the basin.

A recent publication by the Institute of Transportation Engineers on air quality analyses reports that impact estimates currently available strongly suggest that in urban areas where emission must be reduced by more than 2 to 3 percent it may be necessary to rely on packages of control measures, or strong regulatory measures, or both. The strong regulatory measures mentioned in the ITE publication were gasoline price increases, increased parking costs, and staggered working hours.

For the Lake Tahoe Basin, gasoline pricing probably cannot be applied as a practical measure on a local basis. Increased parking costs and staggered working hours are not likely to be effective because of the large percentage of visitors.

Most of the packages of control measures presented in the ITE publication indicate reduction in traffic volumes of 2 to 6 percent, although a package including reserved bus lanes on arterial streets indicated possible reductions of about 15 percent in morning peak-hour corridor traffic.

Specific applications of individual control measures in the Lake Tahoe basin have been discussed and evaluated (on a qualitative basis) as part of the Lake Tahoe Basin Nonattainment Plan. Similar lists of measures had been considered previously in the TRPA and CTRPA transportation plan reports, and are currently being proposed for the U.S. 50 corridor through the South Lake Tahoe area as the result of a joint study by the City of South Lake Tahoe, El Dorado and Douglas Counties, Caltrans, and the Nevada Department of Highways.

None of the individual measures previously considered has a reasonable likelihood of significantly reducing traffic volumes in the Lake Tahoe basin. Traffic volume reduction is most likely to occur as a result of the combination of effective transit services and controls on the use of automobiles. However, the special conditions that exist in the Lake Tahoe basin, including the unusual trip characteristics of residents and visitors, should be taken into account in planning transit improvements and automobile control measures. The application of approaches used in typical urban areas are not likely to prove effective in the Lake Tahoe basin.

Normal transit practice is concerned almost entirely with service to central urban areas where the character and purposes of transit are very different from requirements in the basin. Furthermore, the standard approaches to transit management are primarily concerned with labor and fiscal matters. Management of transit services in the basin should be concerned with the extreme variations in travel patterns, the recreational nature of most of the trips, and the importance of not disturbing, or detracting from, the natural environment of the basin. The agency should also be concerned with eliminating the need of automobiles for a large percentage of the residents and visitors in the basin, which is an unprecedented concern in the management of most urban transit systems.

Designing a transit agency on an urban model could prevent transit from becoming an effective service in the basin. In order to be effective, the agency that manages the transit services should also regulate the use of automobiles, and should manage the principal roads in the basin. Again, the agency should be primarily concerned with the basin's natural resources, with their preservation, and with the enhancement of the public's appreciation and enjoyment of them.

Development exists in relatively compact concentrations within a single corridor along the Lake Tahoe shoreline. Although this form of development is favorable for transit, other conditions in the basin, such as low density, automobile-orientation of development, and lack of pedestrian facilities, are not favorable to transit.

In order to be successful, transit improvements should be specially tailored to the particular conditions and characteristics in the Lake Tahoe basin. Some of the features that would help transit to become effective are not usually found in urban transit systems--features such as: local services for very short trips, flexibility of routes and schedules to meet continually changing travel desires, and continuous participation by local users in the planning of service changes.

Other requirements for successful transit would include: pedestrian system improvements, design of a change to pedestrian orientation of development at principal transit stops and transfer points, coordination of land development with transit routes and stops, friendliness and helpfulness of drivers and other transit staff, and equipment suitable in appearance to the surroundings.

The above features are different from normal urban transit standards, and suitable treatment of them is probably so important it will determine the success or failure of transit in the Lake Tahoe basin.

Transit is not likely to be effective if it is expected to substitute for automobiles in serving the existing patterns of travel in the basin. Public transit offers advantages over automobiles, but it is not a substitute. Its characteristics are very different and its most effective use implies a different way of doing things in the basin. The use of buses to replace automobiles for circulation and access along the canyon rim in Grand Canyon National Park is an example of how a transit-based system can be more effective than an automobile-based system with a suitable change in the patterns of activity. Therefore, in order to be effective, the planning of transit services should be treated as a linking element within an areawide design that includes land use and development controls, landscaping, and the aesthetic treatment of improvements. This approach would be called urban design in an urban area.

The positive regulation of automobile use is necessary for any substantial shift in ridership from automobiles to transit. Although a basin user fee on automobiles may be necessary to pay for the transit system that is needed to reduce traffic, the fee (even in combination with traffic congestion) cannot be expected to shift a large percentage of riders from automobiles to transit. One method of regulating auto use would be to manage the basin's principal road system as roads in many state and federal parks are managed. Vehicles could be allowed to pass freely during low-volume periods, but in peak periods they could be stopped and their occupants given the options of waiting for traffic conditions to clear, transferring to transit, or bypassing the basin.

Following are selected measures that would be likely to help reduce traffic volume in the basin. Comments are included, where appropriate, to describe the measure and its purpose:

1. Exclusive bus lanes or light rail service on U.S. 50 through the South Lake Tahoe area.

2. Local transit services: In designing transit services, particularly in South Lake Tahoe, circulation within each local zone or neighborhood should be emphasized. The local service should provide for short trips to points within and near the local area as well as provide access to transfer points on longer transit lines. Most of the trips that people make are short trips. If these could be served adequately by transit, more people would feel less compelled to rely on automobiles and would use transit also for their longer trips. Emphasis on local service is a major departure from standard, urban transit practices, but the local emphasis should be made in the Tahoe Basin.

3. Flexibility of transit service: Trip destinations and patterns of the Tahoe Basin change by season, by day and by hour. Trip-making is different also in different areas. The transit service should be flexible in order to meet changing travel needs as they occur, including special events, emergencies, unscheduled stops, passenger

assistance and package deliveries. If the local portion of the transit service is flexible enough to meet special and changing travel needs, more people would be willing to rely on transit instead of automobiles. Flexibility of local services is a major departure from standard, urban practice, but should become a transit policy in the Tahoe Basin.

4. Responsiveness of transit services: In order to satisfy local travel needs, to anticipate changes, to adjust services quickly when necessary, to evaluate the effectiveness of changes, and to detect problems and causes, it is necessary to receive current and accurate information on travel characteristics, attitudes and problems within each local service area. Such information requires the participation of local residents and businesses in the operation and management of transit services in their area. Although most urban transit agencies have constant contact with the public for purposes of marketing, providing information, and receiving complaints, participation by the public in operating and management decisions is usually avoided. Responsiveness and openness to public participation in local transit services is a major departure from standard, urban transit practices, but should be applied in the Tahoe Basin.

5. Attractive transfer arrangements: Transfers are usually considered to be one of the principal deterrants to transit use. The main reasons are: uncertainties about routes and schedules and the possibility of a long wait at an expoosed and alien site. It is essential to the success of transit that transfer sites be reassuring,

convenient, comfortable, attractive and interesting. Current development along U.S. 50 is oriented to automobiles. Transfers should be located and designed to change the environment to pedestrian orientation at each transfer point. Land use regulations to coordinate land development with transit could encourage higher densities, concentrations of pedestrian activities, improvement of walks and reduction of road and parking space at transfer points.

6. Coordination of land use and transit: This is one of the most important measures for increasing transit use and reducing traffic volume. The purpose of the coordination is to encourage development at higher densities and in locations that are best served by transit.

7. Character of transit service: Transit vehicles, transfer points and stops should be appropriate to the setting not only in physical appearance but also in the character of operation. The appearance of the transit system should not detract from enjoyment and appreciation of the natural environment. The attitudes and manner of operating the system should be friendly and informal in keeping with the recreational purposes of most of the visitors in the Basin.

8. Provide pedestrian links to transit: Sidewalks and other pedestrian amenities are needed to encourage use of transit.

9. Improve bicycle paths and storage facilities in developed areas: A large proportion of the trips in the South

Lake Tahoe area are short trips that could be made conveniently by bicycle if there were safe places to ride bicycles and secure, convenient places to store them. Bicycle trails in outlying areas are desirable for recreational purposes, but bicycle facilities in the developed areas would provide a useful alternative to the automobile for other trip purposes in addition to recreation.

10. Positive regulation of automobile use: Regardless of the convenience and benefits of other modes of travel, it may be difficult to change the prevailing habits of automobile use, which are probably based as much on attitudes and psychological factors as on considerations of convenience, comfort or economy. Although a basin user fee is an appropriate and useful measure, the addition of a more positive regulation of automobile use may be necessary to reduce traffic volume to an acceptable level.

One method of effective control would be to manage the basin's major road system as many state and federal parks are managed: by intercepting vehicles at the entrances to the basin and providing information, collecting fees, issuing permits, etc. Additional check points could be located to control traffic through special areas in the basin such as Emerald Bay and Sand Harbor. Vehicles could be allowed to pass freely through the entry and check points during off-peak periods, but in periods of heavy traffic volume, vehicles could be stopped and delayed until conditions ahead were sufficiently clear, or drivers would have the option of using transit or turning back.

At the west entrance of the basin on U.S. 50, drivers could be given the option of bypassing the South Shore by turning south onto State Highway 89 near Meyers and continuing west through Alpine County on State Highway 88 to U.S. 395 in Nevada. It would be possible also to redesignate the bypass route at U.S. 50, improve it as required for safety and conformance with the remainder of U.S. 50, and remove the highway designation from the route in the basin. The entire system of major roads within the basin could then be managed by a single agency.

The primary purpose of the agency would not be to control traffic, but would be to preserve and protect the natural resources of the basin and to support and enhance public access and appreciation and enjoyment of those resources.

11. Character of transit management: Most of the experience in transit operation and management comes from urban areas where transit service is limited primarily to commuters and other workers in central business districts, and to students. The principal concerns of most urban transit agencies are the handling of labor problems and operating within a limited budget.

    The standard approaches to transit management that are applied in urban areas could be detrimental to the success of public transit development in the Tahoe Basin. The formation of a transportation district to manage only transportation matters could place that agency in a similar position with urban transit operators who are forced to become more concerned with labor and finance than with the nature and quality of the transit service or with other benefits that transit might bring to the areas affected.

As in the case of managing the road system, the primary purpose of the agency managing transit would not be to provide transit services, but would be to protect the natural resources of the basin and to support and enhance public access and appreciation and enjoyment of those resources. The management of Grand Canyon National Park by the National Park Service is an example. Visitors are transported by buses that are run by a private operator under contract to the park service. This could be an appropriate arrangement for the Lake Tahoe Basin also.

12. Waterborne services: The use of ferries on the lake is not likely to have a significant effect on traffic volumes. The effect of ferries on vehicular traffic would be negligible. In view of potential environmental impacts, such as noise, intrusion, wave action and spillage, the uncertainty of costs, and the fact that the service is likely to be used primarily for sight-seeing and pleasure trips, it would be appropriate to separate waterborne ferry service from the transportation plan and treat it independently as a possible recreational development.

3. RECREATION

TABLE D-20

U.S. FOREST SERVICE DEVELOPED SITES IN LAKE TAHOE BASIN MANAGEMENT UNIT

Recreation Use

Calendar Year 1977

Type of Use & Name of Site	Developed Acreage[1]	Theoretical Maximum Capacity	Reported Recreational Use[2]	% of Capacity[3]
OBSERVATION SITE				
Eldorado NF				
Bayview	1	4,200	1,100	26.19
BEACHES				
Eldorado NF				
Baldwin Beach	10	109,200	39,000	35.71
Pope Beach	20	267,120	75,900	28.41
Toiyabe NF				
Nevada Beach	32	181,170	43,200	23.84
Tahoe NF				
William Kent	1	9,300	1,800	19.35
Total: Beaches 5	63	566,790	159,900	28.21%[4]
PICNIC GROUNDS				
Eldorado NF				
Bayview	4	13,860	0	0
Kiva*	20	18,480	14,300	77.38
Eagle Falls	3	12,600	3,600	28.57
Tahoe NF				
Kaspian	5	39,975	1,300	3.25
Toiyabe NF				
Spooner Summit Rest Area	2	7,095	400	5.63
Total: Picnic 5	34	92,010	19,600	25.08%

TABLE D-20 (Continued)

Type of Use & Name of Site	Developed Acreage[1]	Theoretical Maximum Capacity	Reported Recreational Use[2]	% of Capacity[3]
INFO CENTER				
Eldorado NF				
Lake Tahoe Visitor Center	75	171,200	49,800	29.08
Tahoe NF				
Stateline	3	15,300	500	3.26
N. Tahoe Visitor Center	1	1,395	500	35.84
Total: Info. Center	79	187,895	50,800	27.04%
CAMPGROUNDS				
Eldorado NF				
Pine Flat	15	27,800	13,000	46.76
Fallen Leaf	75	346,880	98,100	28.34
Camp Richardson	40	445,200	97,300	21.85
Craven	2	6,160	1,300	21.10
Meek's Bay Resort[5]	10	184,800	14,700	7.95
Tahoe NF				
William Kent	22	116,850	37,500	32.09
Toiyabe NF				
Nevada Beach*	28	65,880	44,000	66.78
Total: Campgrounds 7	192	1,193,570	305,900	25.63%

TABLE D-20(Continued)

Type of Use & Name of Site	Developed[1] Acreage	Theoretical Maximum Capacity	Reported Recreational Use[2]	% of Capacity[3]
RESORT (LEASED ON NF LAND)				
Eldorado NF				
Meeks Bay Resort*	20	77,000	56,000	72.72
Camp Richardson	35	252,000	49,800	19.76
(OWNED ON NF LAND)				
Eldorado NF				
Echo Chalet	8	46,200	2,600	5.62
Angora Lakes*	5	5,480	3,300	60.21
Total: Resorts 4	68	380,680	11,700	29.34%
ORGANIZATION CAMPS				
Eldorado NF				
California Alpine Club*	1	3,080	5,800	188.31
Camp Harvey West	19	47,950	0	0
Berkeley Camp	14	31,635	2,900	9.16
Camp Concord	12	27,720	4,100	14.97
Camp Shelley*	9	15,400	8,400	54.54
Total: Organization Camps 5	55	125,785	21,200	27.24%
STABLES				
Eldorado NF				
Camp Richardson Corral	6	8,400	1,800	21.42

TABLE D-20 (Continued)

Type of Use & Name of Site	Developed Acreage[1]	Theoretical Maximum Capacity	Reported Recreational Use[2]	% of Capacity[3]
SKI AREA				
Eldorado NF				
Heavenly Valley (on NF land)	19	840,000	181,700	21.63
(off NF land)	11	840,000	20,500	2.44
Toiyabe NF				
Heavenly Valley (on NF land)	560	869,440	14,500	3.17
(off NF land)	280	836,000	4,800	1.05
Total: Ski Area I	870	3,385,440	221,500	6.74%
SUMMER HOMES[6]				
Eldorado NF				
Bridge*	13	13,300	8,600	64.66
Echo Summit	59	33,880	17,500	51.65
Fallen Leaf Park	1	924	200	21.64
Emerald Bay*	14	14,630	8,800	60.15
Spring Creek*	180	102,410	78,700	76.84
Fallen Leaf Lake*	34	39,270	27,100	69.00
Fish Hatchery	4	3,080	600	19.48
Alpine Falls	8	8,470	2,700	31.87
Fallen Leaf Lodge*	12	20,328	15,300	75.26
Stanford*	10	8,470	6,500	76.74
Echo Road	16	33,110	13,400	40.47
South Shore*	13	29,260	15,100	51.60
Hemlock	16	23,100	9,900	42.85
Island	2	1,540	700	45.45
No. Shore	10	14,630	6,800	46.47
Channel*	11	15,400	8,900	57.79
Mermaid Cove	11	13,860	6,200	44.73
Lily Lake	7	10,780	2,400	22.26
Lower Angara	4	9,240	2,700	29.22
Upper Truckee	17	14,630	6,400	43.74
Rainbow	19	38,500	18,400	47.79

TABLE D-20 (Continued)

Type of Use & Name of Site	Developed Acreage[1]	Theoretical Maximum Capacity	Reported Recreational Use[2]	% of Capacity[3]
Tahoe NF				
Twin Crags*	12	9,590	8,200	85.5
Fir Crags*	20	10,960	8,600	78.46
Total: Summer Homes 23	493	507,862	263,700	51.95%

* Denotes site used over its 50% capacity.

[1] As of 2/1/78.

[2] In Visitor Days.

[3] 40-50% here is taken to mean 100% in terms of capacity met.

[4] Total: percent of capacity met: this figure is the percent of total use over Total Theoretical Capacity. In calculating this percentage figure, Theoretical Capacity for sites closed for the season (see Picnic Sites and Organization Camps) was subtracted from the Total Theoretical Capacity.

[5] After acquisition by the Forest Service, Meeks Bay has been allowed a reduced number of visitors in order to facilitate site rehabilitation. This may explain the very low use in this normally crowded area.

[6] USFS land by special permit, under USFS jurisdiction, will revert completely to USFS after specified number of years.

TABLE D-21
LAND ACQUISITION BY THE U.S. FOREST SERVICE SINCE OCTOBER 1977

Name of Purchase and Location	Acreage	National Forest
1. Transamerica Title (Boise Cascade above Incline)	601.5	Toiyabe
2. Carnelian Bay	80	Tahoe
3. Tout purchase near Burton Creek State Park	80	Tahoe
4. TP Land on Truckee River	5.06	Tahoe
5. Kruger Estate on Truckee River	.65	Tahoe
6. Kruger Estate on Truckee River	1.6	Tahoe
7. 14 Company purchase in Ward Valley (near Page Meadow)	278 acres	Tahoe
8. Lake Tahoe Gold Mining Company purchase near Tahoma	503 acres	20 acres in Eldorado 483 acres in Tahoe
9. Fritschi purchase near Glen Alpine	79 acres	Eldorado
10. Gammill Oil purchase near Osgood Swamp (at Meyers-nr. Echo Summit)	160 acres	Eldorado
11. Harrah's Club purchase (beach next to Nevada Beach)	4.5	Toiyabe
12. Rabe Estate purchase (Meadow east of Nevada Beach betw. H-50 and North Forest)	236.	Toiyabe

Source: USFS, 1978.

TABLE D-22

PROPOSED U.S. FOREST SERVICE ACQUISITION BY FISCAL YEAR*

Jurisdiction	FY 78 Acres	FY 79 Acres	FY 80 Acres	FY 81 Acres	FY 82 Acres	FY 83 Acres
El Dorado Co.	640	565	2,910	295	735	210
(STPUD)	(200)	(343)	(370)	(135)	(155)	(0)
Placer Co.	6,660	1,315	200	1,080	2,150	1,050
Washoe Co.	1,220	3,640	2,075	120	0	0
Carson City	0	80	120	0	22	0
Douglas Co.	2,090	1,130	1,090	585	485	925
TOTAL	10,610	6,730	6,395	2,080	3,392	2,185
GRAND TOTAL	31,392					

*Program is contingent upon congressional appropriation to fund acquisition.

TABLE D-23

PARCELS DESIGNATED FOR DEVELOPED RECREATIONAL USE BY LAKE TAHOE BASIN MANAGEMENT UNIT

Site	Location	Capacity	1978	1979	1980
Estates	Eldorado NF (between Camp Richardson and Kiva Beach)	300 PAOT	Study & Design	Construction	
Fallen Leaf Lake 10 acres	Eldorado NF	250 PAOT	Study	Design	Constructio
Nevada Beach Annex 4.5 acres	Toiyabe NF	10 PAOT	Study & Design	Construction	
Rabe Property 236.14 acres	Toiyabe NF	500 PAOT	Study	Design	Constructio
64 Acres[1]	Tahoe City	800 PAOT	Study		

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[1] This property is owned by Bureau of Reclamation and is being turned over to the U.S. Forest Service. It is encumbered by leases, and ownership by the Forest Service is not anticipated before 1979.

Source: CTRPA, pers. comm.

TABLE D-24

STATE RECREATIONAL FACILITIES: LAKE TAHOE BASIN

Site	Activities	Visitor Days	% Change From Previous Year
CALIFORNIA		(7/1/76 - 6/30/77)	
Emerald Bay State Park 590 acres	Camping, Picnicking, Boating, Swimming, Hiking, Visitor Center	197,720	+21.9%
D.L. Bliss State Park 957 acres 280 leased 1,237 acres	Camping, Trailcamp, Picnicking, Swimming, Fishing, Hiking, and Interpretive Trails	80,345	+11.1%
Sugar Pine Point State Park 2,011 acres	Camping, Picnicking, Swimming, Fishing, Hiking	115,446	+21.6%
Tahoe State Recreation Area 15 acres	Camping, Picnicking, Swimming, Fishing	19,527	-3.5%
Ward Creek Acquisition 173 acres	Undeveloped		
Barton Creek State Park	Undeveloped		
NEVADA			
Lake Tahoe-Nevada Recreation Area 13,468 acres total (6,047 within basin)	Picnicking, Boating, Swimming, Fishing, Hiking	800,448 (1977) 1,036,700 (1976)	-22.79% +28.83%

4. PUBLIC SERVICES/FISCAL CONCERNS

EXISTING CONDITIONS

Health

Barton Memorial Hospital in South Lake Tahoe, the only hospital facility in the Lake Tahoe Basin, is a private, nonprofit corporation that serves as a quasi-public and regional facility (CTRPA, 1978a). The hospital serves the population in the southern part of the basin from Spooner Summit to Strawberry. The service area population varies from 30,000 (permanent residents) to over 100,000 on a peak summer day (CTRPA, 1977a). Half of the hospital's patients are tourists, and of the local patients, 87 percent are from California (CTRPA, 1978a).

The hospital offers 24-hour in-patient care and laboratory, radiology, pharmacy, and directory services. It has 62 licensed and 28 unlicensed beds. In 1977 occupancy ranged from 60 percent in June to 95 percent in March (CTRPA, 1977a). Present use amounts to 3,725 patient days per year (CTRPA, 1978a).

There is one skilled nursing facility in the area, which is consistently full, and patients must often be placed in facilities outside the area. The private sector handles most primary health care, but minor emergency care is often provided by the hospital emergency room. Other health services such as mental health, education, drug abuse and alcholism clinics, and rehabilitation services are provided by El Dorado and Placer counties. Residents of the Nevada part of the basin also use these facilities or, more frequently, go to Carson City or Reno. All these services except the alcoholism clinics serve both resident and visitor populations. Tables D-25 and D-26 show use of these health services.

Schools

The Lake Tahoe Unified School District serves the south shore area in California from Emerald Bay to the Nevada stateline. The district has five elementary schools, one intermediate school, and one senior high school. In 1976-1977, 4,257 students were enrolled and 169 teachers were employed. The district has an average of one teacher per 25 students (CTRPA, 1977a). Based on the district's established maximum capacity, 1977 facilities and staffing could accommodate an additional 1,151 students or a 27 percent increase (CTRPA, 1977a). For the long term, a new intermediate school and new high school are envisioned, but neither is funded at the present time.

Schools of the Douglas County School District in the Lake Tahoe Basin served 705 students in 1977-78. Existing and planned facilities in this portion of the district could accommodate 100 to 200 additional students.

The Lake Tahoe Community College District serves the same area as the Lake Tahoe Unified School District. In 1977 its enrollment was about 1,450 (CTRPA, 1977a). The college, in a converted hotel in South Lake Tahoe, has some constraints

TABLE D-25

HEALTH SERVICES USE PATTERN
1976-1977

Health Service	Cases Per Year
Barton Memorial Hospital	3233[1]
Tahoe Forest Hospital	1331[1]
El Dorado Mental Hospital	4080 (average)
Sierra View Mental Health Center (Placer County)	1428 (average)
El Dorado County Health	9835 (visits)
Placer County Health	3900 (visits)
People Against Rape	300 (calls) 45 (rape crisis)
Wakening Peace Youth Counseling Center	200
Alcoholism Council of the Sierra Nevada	900 (average)
Sierra Council on Alcoholism	4500 (average)[2]
Voluntary Action Center	100+[3]

[1] Does not include out-patients.

[2] Also serves Nevada and Sierra counties.

[3] Includes Volunteers in Action and Meals on Wheels recipients.

Source: CTRPA, An Analysis of the Carrying Capacity of the California/Tahoe Region. Health Element, November 1977.

TABLE D-26

CLINIC HEALTH SERVICES USE PATTERNS[1]
TAHOE BASIN, 1976-77

Clinic	El Dorado County	Placer County	Total
Family Planning	2216	1609	2825
Pregnancy Testing	910	513	1189
Pregnancy Counseling	914	279	914
Venereal Disease	2532	865	3397
Well Child	266	338	604
Immunization	2794	168	2794
Tuberculosis	85	5	90
WIC[2]	--	17[4]	17
Crippled Children Service	--	40	40
CH & DPP[3]	118	66	184

[1] Figures in most cases represent visits.

[2] Women, Infants, and Children Program

[3] Child Health and Disability Prevention Program

[4] First 6 months only.

Source: CTRPA, An Analysis of the Carrying Capacity of the California/Tahoe Regions Health Element, November 1977.

on capacity resulting from small facilities, lack of specialized classrooms, and the inability to expand at its present location. However, current staff and facilities could accommodate about 2,450 students (CTRPA, 1977a).

Law Enforcement

In the city of South Lake Tahoe, police services are allocated about equally between permanent residents and tourists. The ratio of sworn personnel to permanent population is about 1.7 per 1,000, slightly below the national average of 2.1 per 1,000 for rural areas. The ratio of personnel to resident population served is actually much lower, as the visitor population averages 30,000 daily, with peaks as high as 125,000. Service deliver is therefore, at present, severely constrained during peak population periods.

In Douglas County, police services are allocated about one-fourth to permanent residents and three-fourths to tourists. The ratio of sworn personnel to the permanent population is about 3.1 per 1,000, substantially higher than the national average for rural areas. Here, again, however, the visitor population ranges from 80,000 to 135,000, and service delivery is severely constrained during peak population periods.

The El Dorado County Sheriff Department maintains a substation in South Lake Tahoe to cover the unincorporated areas around Lake Tahoe within county boundaries. The substation is on call to South Lake Tahoe, but is used infrequently by the city.

Fire Protection

The south shore areas are provided with at least a minimum level of fire protection services. The Insurance Services Office recommends that rural fire protection be at the 8 rating or better on a scale of 1 to 10 (1 being the best service). The populated areas of the south shore have fire protection services rated at 5, 6, and 7 (CTRPA, 1977a).

In the city of South Lake Tahoe, the fire department has three stations and sufficient personnel and equipment to provide an adequate level of fire protection to the city. Water flow and response time are problems in a few areas (CTRPA, 1977a).

The two stations of the Lake Valley Fire Protection District are sufficient to provide adequate levels of service in most areas of El Dorado County within the district. However, development of subdivisions at some distance from stations may make building new stations necessary (CTRPA, 1977a).

Fire protection services of the Kingsbury District and the Tahoe-Douglas District are adequate with ratings of 5, the highest among the south shore areas.

The U.S. Forest Service and the Nevada State Department of Forestry have fire protection jurisdiction throughout the basin. Their primary purpose is to control forest and range fires. Within the STPUD area, the Forest Service has responsibility for fire protection in all nonurbanized areas, including privately owned, undeveloped lots. Throughout the south shore area, there is cooperation between all fire districts and forest services.

Solid Waste

The key factor affecting solid waste operations and management in the study area is the TRPA ordinance mandating export of garbage and other solid waste from the Lake Tahoe Basin. Issued in August 1969 to protect the fragile environment of the basin, the ordinance required local communities to arrange for disposal outside of the basin. Both the city of South Lake Tahoe and El Dorado County have contracted with the South Tahoe Refuse Company to provide collection and disposal service in the southern portion of the basin. The franchiser, franchisee, and disposal sites for other service areas in the basin are shown in Table D–27.

The South Tahoe Refuse Company, which serves 13,000 customers in the south shore area, operates a fleet of packer trucks that makes regular collections and delivers solid waste to a transfer station near the intersection of U.S. Highway 50 and Highway 89. The transfer station also accepts waste from citizens who haul their own waste to the site. The facility processes 120,000 cubic yards per year, or 70 percent of the solid waste produced in the service area, for eventual disposal at the sanitary landfill. Because of the inefficient design of the transfer station, traffic backups and packer delays occur frequently. At present, only one vehicle can be served at a time, which, in turn, causes the compactors to lay idle for long stretches of time.

Garbage and solid waste from the transfer station are transported 97 miles to a 112-acre sanitary landfill east of Gardnerville in Douglas County, Nevada. Leased by Douglas County from the Bureau of Land Management, the landfill is operated and maintained by the South Tahoe Refuse Company. The company uses the area method of landfilling, in which waste is deposited into working trenches and compacted into blocks. The blocks are placed side-by-side until the entire site is covered, at which time a second layer of blocks is started. Because the blocks of compacted waste can be piled one on top of the other, there is no landfill capacity *per se*, although the life of the facility has been estimated at 50 years (CTRPA, 1977a).

In additional to solid waste disposal by landfill, disposal by incineration is used. The South Tahoe Public Utilities District, for example, incinerates its sludge, and ashes from this and other basin incineration processes are collected by the South Tahoe Refuse Company and deposited at sanitary landfills.

TABLE D-27

SOLID WASTE MANAGEMENT SYSTEMS IN THE LAKE TAHOE BASIN

Service Area	Franchiser	Franchisee	Disposal Site
City of South Lake Tahoe	City of South Lake Tahoe	South Tahoe Refuse Company	Gardnerville
El Dorado County (excluding South Lake Tahoe) south of Emerald Bay	El Dorado County	South Tahoe Refuse Company	Gardnerville
Emerald Bay to Placer County Line	El Dorado County	Tahoe City Disposal Company	North Tahoe Sanitary Landfill
Placer/El Dorado County line to Dollar Point	Placer County	Tahoe City Disposal Company	North Tahoe Sanitary Landfill
Dollar Point to Stateline	Placer County	Kings Beach Disposal Co., Incorporated	North Tahoe Sanitary Landfill
Incline Village GID	Incline Village GID	Independent Sanitation Company	Carson City Dump
Washoe County excluding Incline Village GID	Washoe County	Independent Sanitation Company	Mustang Dump east of Reno
Carson City	None	None	None
Douglas County	Douglas County	South Tahoe Refuse Company	Gardnerville

The volumes of solid waste collected and disposed of that are reported in the main text of this were calculated using the following formulas.

(1) per capita generation figure = $\frac{\text{Volume of solid waste collected 1978}}{\text{Person-days 1978}}$

= cubic yards/person/day

where 1978 calculations = 186,515 cubic yards, from South Tahoe Refuse Company.

Person-days = 24,657,800, based on year-round occupancy by permanent residents and visitor days including the following groups: secondhome owners, hotel/motel visitors, other visitors, and campers. Visitor day estimates are made by Recht-Hausrath & Associates.

(2) projected cubic yards = (per capita generation figure) X (projected person-days)

where per capita generation figure = the figure computed from formula (1) above and is assumed to remain constant over time.

projected person days = rough estimates by Recht-Hausrath & Associates as follow:

	Growth Scenarios				
	1	2	3	4	5
Permanent resident days	14,337,200	17,359,400	18,717,200	18,082,100	21,633,550
Overnight visitor days	15,014,450	19,655,830	20,001,950	22,344,310	25,055,230
Total Person-Days	29,351,650	37,015,230	38,719,150	40,426,410	46,688,780

Upper Carson River Basin projected cubic volumes are calculated according to formula (2) above, except projected increases of spillover population is used instead of "projected person-days." Figure for spillover population increases are given in the energy discussion following this section.

The following formula is used to calculate "truck trips/day":

$$\frac{\text{volume of solid waste collected per year}}{\text{days in a year} \times \text{capacity of the transfer trailers}}$$

where volume of solid waste collected = the cubic yards collected/year, as computed above.

capacity of the transfer trailers which transport the solid waste to Gardnerville = 73 cubic yards.

The following formulas are used to calculate "depletion of Gardnerville landfill":

(1) cubic yards of fill utilized per year =
(volume of solid waste collected) x (settlement factor) x (cover factor)

where settlement factor = .40. This accounts for 60% consolidation of the waste because of additional compaction by machinery by the weight of other wastes and cover.

cover factor = 1.25. This accounts for the fact that cover is spread over the compacted solid waste at a ratio of 1:3, so that volume is increased 25%.

(2) surface area of fill utilized per year = $\frac{\text{(cubic yards of fill utilized per year)} \times k}{\text{depth of compacted waste} \times m}$

where k = conversion factor = 27 cubic feet per cubic yard.

depth of compacted waste, including depth of cover = 12 feet.

m = conversion factor = 43,560 square feet per acre.

For the Upper Carson River Basin, "depletion of Gardnerville landfill" is based on the estimate that 85% of the deposited materials come from the Lake Tahoe Basin.

Consequently:

(1) Total volume deposited at landfill = $\frac{\text{Tahoe Basin portion}}{85\%}$

= 219,430 cubic yards

(2) Upper Carson River Basin portion = (15%) X (219,430)

= 32,915 cubic yards

Acres of fill utilized are computed in a fashion similar to that explained above for the Lake Tahoe Basin.

IMPACT ASSESSMENT: COST CONSIDERATIONS

The major cost considerations of providing a particular public service are: (a) the distribution of total costs of that service between costs that are fixed (costs associated with the use of resources such as land, buildings and heavy machinery whose costs cannot be varied for a given set of capital facilities) and costs that are variable (the costs of those resources such as labor and supplies which can be varied), and (b) the capacity at which the existing capital facilities are operating.

For public services requiring large investment in capital facilities, such as sewage and water systems and major roads, fixed costs are likely to represent a large percentage of total costs. As a result, costs per unit of service output could increase or decrease with the provision of additional output, depending on amount of unused capacity of the existing facilities. If excess capacity existed, per-unit service costs would decrease, since the fixed costs would be spread over more units of output. However, if operations are at capacity, additional service demand would either stretch existing facilities beyond their optimum rate of output or necessitate investment in new capital facilities, both of which often increase per-unit costs.

For public services in which variable costs represent the larger share of total costs, per-unit costs of service output are less likely to be affected by increases in service demand and total costs. Costs per unit of output for these types of services--which would include police protection and other personal government services--are determined much more by the quality of service provided as related to the desires and needs of the community (related to socio-economic makeup of the population) than by the quantity of services provided, per se, in terms of the size or growth of the population served.

Cost considerations applicable to the provision of the major public services are discussed below.

Public Schools

In general, cost efficiencies due to growth are possible only if underutilized facilities are available in local school districts. Capital expenditures, probably resulting in increased per-unit service costs, would be required if classroom facilities are needed to accommodate a growth in students. Operating costs, which account for the majority of total school costs, typically rise in proportion to increases in students if student-teacher ratios remain somewhat constant. Therefore, operating costs are unlikely to vary on a per-unit basis among scenarios. However, increased student-teacher ratios could result in lowered per-unit operating costs, although at the risk of a possible decline in the quality of education.

Fire Protection

To a large degree, the provision of fire protection services represents a fixed cost. Once a station is established with full-time personnel, the total cost of providing services to an area is roughly the same whether fire crews respond to one or five fires per day. This characteristic allows for efficiencies of service resulting from growth, if development occurs as infilling or adjacent to already developed areas, and if the level of growth does not overburden the capacity of existing personnel and equipment. Therefore, growth usually results in a lowering of the per-unit costs of providing fire protection services if stations are more efficiently utilized. Even if increased service demands require additional personnel or equipment to maintain existing service quality but do not necessitate the construction of new stations, somewhat lower per-unit service costs could result.

Law Enforcement

Law enforcement services can also gain certain efficiencies with growth, especially when infilling allows more optimal deployment of patrols. Growth also permits increased efficiency with respect to the use of communications equipment and stations. However, efficiency related to growth is likely to be less significant for law enforcement services than for fire protection services. Since the majority of police and sheriff service costs are variable costs (such as expenses for personnel and equipment), per-unit costs are unlikely to vary significantly among scenarios to the extent that comparable levels of service are provided. It can also be noted that, although law enforcement demand correlates roughly with population, it is also influenced by the socio-economic makeup of residents and visitors.

Water and Wastewater Services

For a description of the likely impacts on water and wastewater service costs, refer to sections on water supply and water quality.

General Government

It is not possible to generalize about the effects of growth on the costs of providing general government services. Because some services are supplied whether an area is large or small (such as components of municipal or agency administration), the marginal cost of serving a level of growth may be slight, resulting in lowered average (or per-unit) service costs. Other general government services may lose efficiency at higher levels of output that could accompany growth. It is also possible that the increased size of communities may raise expectations for certain urban services, which might have been inefficient to provide and not expected for small levels of population and development. These latter two considerations, loss of efficiency and higher expectations, may result in additional per-unit costs.

Transportation

Fiscal concerns regarding transportation services cannot be considered until the assessment of impacts and evaluation of mitigation measures are completed, as impacts often represent deterioration in the level of service, and mitigation represents expenditures necessary to maintain the service level.

Some generalizations can be stated which illustrate the complexity of transportation system unit costs. First, transportation costs are incurred both privately and publicly. Minimizing total unit costs may result in increased public costs, as when an efficient public transportation system replaces a significant amount of private vehicle usage.

It is also difficult to generalize about the relationship between public per-unit costs and increased community size. A minimum amount of roads are necessary for even a small community. An increasing population will require some more roads, but proportionately less than the increase of population, and per-unit costs are likely to decrease. This favorable situation lasts until congestion in developed areas occurs. Then, maintaining the prior level of service requires either new roads which are very expensive to build in developed areas or a public transit system, both of which is likely to raise per-unit costs. Even more growth, however, may again lower per-unit costs, if public transit usage increases. The south shore is generally in the latter two situations. Congestion exists and new roads or more public transit are needed; yet some transit expenses are being incurred and greater system usage would lower unit costs.

IMPACT ASSESSMENT: REVENUE CONSIDERATIONS

The major consideration with regard to the impacts of growth on public service revenues is the extent to which the ability to collect revenues per unit of service output varies as a function of (a) the overall growth under all scenario, and (b) the distribution of growth among areas within the south shore. The concern here is with the ability to generate and collect revenues per unit of service output.

The first factor, overall growth, considers how the mix of new land uses (types, values, scale, etc.) and population groups (residents, visitors, mix of income groups, etc.) affects the ability to generate service revenues in proportion to the increases in services it requires. If it appears that increases in revenue resulting from growth would not be proportional to increases in required service outputs, then revenues per unit of service output vary as a function of the level and/or type of growth.

The second factor, distribution of growth, considers differences in the ability to generate revenues in locations where growth occurs, primarily as a function of differences in laws and policies concerning the types and amounts of taxes and notax revenues collected. in considering this question, attention was first given to differences in laws or policies among states or service jurisdictions which affect the levels of service revenues produced and then to how the locational distribution of growth among scenarios would result in different revenues generated per unit of service.

Revenue considerations applicable to the major sources of public revenues are discussed below.

Property Tax Revenues

The ability to generate property tax revenues is affected by overall property values and by the rate at which values is taxed, including recognition of any tax or tax rate limits that may exist.

Property Values. Generalizations regarding overall property values as a function of growth are similar to those regarding housing price trends. Some differences among scenarios relate primarily to the expansion of the housing supply relative to economic growth and housing demand. Property values are highest per unit of service output when housing is in relatively shortest supply and when the incomes of consumers residing in and visiting south shore are highest.

In general, for each scenario the location of high value development will affect the tax base of individual service agencies. However, under the Proposition 13 enabling legislation temporarily in effect in California, increases in assessed valuation that occur anywhere in El Dorado County are shared for taxing purposes by all taxing jurisdictions. Therefore, new development or increases in the value of existing property benefit other jurisdictions besides the one in which they take place. It is likely, however, that the permanent tax allocation formulas will be revised so that local service agencies receive the majority of property tax benefits resulting from growth of assessed valuations within their boundaries.

In both California and Nevada, the market value of new development is roughly equal to the selling price of the total cost of development. In California, however, Proposition 13 limits future increases in the market value for taxing purposes to 2 percent per year (except if properties change ownership, when the market value can be adjusted to reflect full cash value), less than the likely rate of inflation. In Nevada, the increase in the market value of property is not constrained by legal limits. Thus it is likely that market values for taxing purposes will increase more in Nevada than in California for comparable properties and contribute more tax revenues per service unit over time. If Question 6 (a Nevada initiative similar to Proposition 13) is approved by the Nevada voters in 1980, the limitations on the rate of increase in market values would be essentially the same in both states.

Property Tax Rates. Differences in state regulations regarding property assessment and tax rates could affect the amount of per-unit property tax revenues collected. In Nevada, a tax rate of $5 per $100 of assessed valuation has been established by state law. Many taxing jurisdictions in Douglas County are close to this limit. Assessed valuation in Nevada is defined as 35 percent of market value, resulting in a maximum real tax of 1.75 percent.

In California, Proposition 13 established that property taxes could not exceed 1 percent of market value (except for taxes required to retire existing bonded indebtedness).

If properties in both Nevada and California were taxed at the maximum rates allowable, revenues generated in California would be roughly 55 percent of the revenues generated in Nevada for properties of comparable value. Thus, under current tax laws, scenarios that project a larger proportion of future south shore development on the Nevada side could result in higher per-unit property rax revenues.

If Question 6 is approved, property taxes in Nevada would be limited to 1 percent of market value. The property tax limits in both states would then be essentially the same, and there would be no significant difference among scenarios in the ability to generate per-unit property tax revenues.

Sales Tax

Retail sales tax revenues would probably increase in proportion to population growth and associated service demand. Thus, there would be no significant difference among the scenario in the overall relationship between increased sales tax revenues and levels of growth.

The locational distribution of future development, however, could affect the level of revenues generated per unit served. The existing regulations governing the allocation of sales tax revenues allow local service agencies in Nevada to obtain more tax revenues per dollar of taxable retail sales than service agencies in California. Douglas County and the Douglas County School District receive tax revenues equivalent to 1.5 percent of taxable retail sales (the county receives .5 percent and the school district receives 1 percent). El Dorado County and the City of South Lake Tahoe receive tax revenues equivalent to approximately 1 percent of taxable retail sales. Accounting for the difference in items exempted from taxation in each state, the amount of local sales tax revenues resulting from expenditures in California would be roughly 55 percent of the revenues generated from comparable sales in Nevada. Therefore, scenarios that estimate an increase in Nevada's proportion of total south shore commercial floor space would result in a greater ability to generate per-unit revenues.

Gaming Levies

Revenues collected from gaming licenses and taxes would increase roughly in proportion to population growth and to increases in total south shore service demand. Thus, there would be no significant difference among alternatives in the overall relationship between increased gaming tax revenues and levels of growth.

The locational distribution of future development, however, could affect the degree to which service agencies benefit from additional gaming tax revenues. Since gaming revenues would be available only for the funding of services in Nevada, scenarios that assign a greater proportion of total south shore population growth to Nevada could better take advantage of increased gaming revenues. Yet, scenario that assign proportionately less population growth to Nevada would probably result in the ability to generate higher gaming tax revenues per unit served in Nevada since the increase in population-related service demands in Nevada may be comparatively less than the increase in gaming tax revenues attributable to total visitors and residents in the entire south shore area.

Transient Occupancy Tax and Room Tax

Local governments in California and Nevada can levy a tax on rents charged for the use of hotel and motel rooms and second homes by persons staying less than 30 days. The transient occupancy tax in the California portion of the south shore and the room tax in the Nevada portion both equal 6 percent of such rents. Apparently only a very small percentage of second home occupants pay the tax (Economic Research Associates, 1976).

Assuming that future growth in tax revenues would be principally attributable to increases in hotel/motel rooms and visitors, it is likely that there would be no significant difference among scenarios in the ability to generate revenues per unit served. In other words, it is likely that the relationship between increases in hotel and motel occupants (with their accompanying service demands) and increases in tax revenues would be roughly similar for each scenario.

To the extent, however, that Nevada average tax revenues per room are higher (attributable to differences in room rates between casino hotels in Nevada and motels in California), hotel/motel development in Nevada would result in more revenues per unit served than in California (Dornbusch & Company, 1978; research conducted for this study). It is not clear, however, that these relationships would apply to future hotel/motel development.

Special Assessments

Special assessment revenues are collected to raise capital needed for costly infrastructure and public service facilities. They are assessments or fees levied against the owners of the land that benefit from the services and facilities provided. Since these revenues are collected on vacant land as well as improved property, it is the ability to develop land within the areas served (not the actual addition of development) which provides the ability to collect these revenues. Thus, they do not increase in proportion to total south shore growth but as a function of the ultimate amount and location of development that is allowed.

Since the high growth scenarios provide the ability to buildout all areas where special assessments now exist, they provide the best ability to collect these revenues. Since the location of development under the medium and lower growth scenarios is not certain, they offer less potential for generating these revenues.

There are outstanding bonds being repaid by special assessments and other direct levies and fees in areas of both California and Nevada. A detailed, parcel-by-parcel inventory of outstanding indebtedness is not readily available.

State and Federal Subventions

Revenues allocated from state sources have played an increasingly important role in the funding of local public services. Many of these funds have been distributed roughly in proportion to population, although other factors have influenced the allocations. State aid has been a particularly major source of revenue for school districts.

It is extremely difficult, however, to predict the future level of state revenues and the procedures for their allocation. Proposition 13 has created pressure for increasing state support of many local services in California, and it is likely that if Question 6 is approved in Nevada similar efforts to increase state contributions to local governments and service agencies will be forthcoming. In California, the state budget surplus has helped fund local services that experienced revenue losses due to Proposition 13. Since the surplus will eventually be exhausted and an increase in state taxes does not appear likely, the ability of the state to assume a larger portion of local service financing is in doubt. At this time it is not possible to generalize about the effect of the scenarios to generate per-unit state revenues.

Federal revenues also contribute significantly to the funding of some local programs. The formulas used to determine the allocation of federal revenue sharing funds consider population, income, tax effort, and other factors. Generalizations about the effect of the scenarios on future levels of federal revenue sharing and other grants are not possible.

User Fees

Many local governments and public agencies collect a sizeable amount of revenues by sharing directly for the provision of services. User fees, as these charges are typically called, require those who use services to pay generally in proportion to the level of service consumed. Since user fees are related directly to services provided, the amount of revenue derived from the fees usually increase roughly in proportion to growth and associated service demands. It is unlikely that there would be significant differences among the scenarios to generate per-unit user fee revenues.

Critical Implications

The cost efficiencies of more growth appear to be of the same order of magnitude as the fiscal benefits of less growth. Thus, it does not appear that the higher growth scenarios result in a less desirable fiscal situation. It is perhaps more likely that they would result in a moderately better situation, although the analysis allowed within the scope of this EIS does not establish this conclusion with any certainty. There may be a point where diseconomies of scale are significant enough so that a mid-level scenario which meets the criteria above would be better than a higher growth scenario, although such a point has not been identified. Unanswered questions regarding transportation services and water supply are particularly important in identifying such a level. Other areas of uncertainty are property tax limits and future property tax allocation formulas.

The comment is often made that development does not pay for itself in a post-Proposition 13 world, implying that growth is fiscally unfavorable to districts faced with revenue limits. A property tax rate of 1 percent of market value may not even be sufficient to fund services at their present level. The eventual consequence of inadequate revenues would be reduced service levels as per-unit costs are reduced to match per-unit revenues. Because growth can potentially improve efficiency, thereby decreasing overall per-unit costs, more growth could improve the fiscal situation of districts faced with reduced revenues. Thus the fiscal evaluation of growth becomes even more appropriately focused on the comparison of service costs under the scenarios.

The perspective here has been regional, but it should be noted that the fiscal impacts of growth are particularly to the many service-providing entities. Since the regional perspective requires that the advantages and disadvantages of a variety of local options be considered, even the best fiscal alternative is likely to leave some districts with significant fiscal problems. Thus, the next step in this type of analysis would be to focus more closely on the specific situations of local jurisdictions so as to refine regional impacts and implement mitigation measures.

MITIGATION MEASURES

Health

1. Expand Barton-Memorial Hospital to twice its present size.

Description. Expansion would require CTRPA designation of Barton Memorial as a regional facility; it would thus be exempted from certain land coverage policies and could expand without purchasing large amounts of land.

Effectiveness. Most effective way to solve lack-of-space problems at the hospital.

Responsibility. CTRPA, Golden Empire and Greater Nevada health systems agencies, LAFCO (creation of bond districts), Barton Memorial Hospital.

Cost. $25,000 for land, $6 million for capital expenditures, and $500,000 annually for operation; would require bond financing and doubling of cost per patient.

Timing. As soon as possible.

2. Construct primary/intermediate care clinic.

Description. This is necessary in order to meet existing demand; it would, in addition relieve overcrowding at the hospital, since a clinic serves many hospital functions but with fewer resources and at a lower cost.

Effectiveness. Could be highly effective if built; would be a response to strong community demand.

Responsibility. CTRPA, Golden State and Greater Nevada health systems agencies, El Dorado or Douglas County, state and federal financing agencies.

Cost. Variable; would depend on facilities and timing.

Timing. Variable; would depend especially upon plans for expansion of hospital.

3. Expand county health services programs and encourage volunteer services.

Description. Due to cutbacks in state and local funding resulting from Proposition 13, expansion of programs would most likely depend upon a reallocation of resources, which would encourage initiation and expansion of volunteer programs. Volunteer staff would be used to augment paid county staff, and money saved could be spent on equipment and space acquisition. Seed money for the Planned Parenthood center, for example, could replace the county clinic of this type.

Effectiveness. Would depend upon community (volunteer) response and perhaps upon acceptance by health workers' unions.

Responsibility. El Dorado and Douglas counties and their health services departments, Golden Empire and Greater Nevada health systems agencies, local resident population, existing volunteer programs.

Cost. Under the first four scenarios, cost should be similar to present expenditures, except for alcoholism counseling, which could require doubling of space even under Scenario 2.

Timing. Undetermined.

Schools, Law Enforcement, Fire Protection, and Other Services (Fiscal Concerns)

4. Ensure that new development locates to take maximum advantage of existing service capacities.

Description. This measure would involve taking a detailed inventory to identify locations and extent of underutilized capacities and then adopting measures to direct growth to these locations. Measures could include reserving allocations of sewage treatment capacities or the instituting of a priority or incentive system for new development.

Effectiveness. The successful implementation of these measures would increase efficiency of service delivery and ensure that revenues are available to meet outstanding commitments on existing infrastructure and service facilities.

Responsibility. TRPA, CTRPA, or some special study team chosen to complete inventory work. Support responsibilities by all service agencies.

Timing. Inventory work could be done as soon as preferred scenario is selected. Implementation measures could be developed at the time of plan revisions to reflect chosen scenario.

5. Adopt system of regional tax-base sharing.

Description. A system of regional tax-base sharing could be instituted to equalize potentials of local areas to collect revenues per unit of service provided. Such a system might begin by sharing only the increase in tax base arising from new development. While this measure could be quite effective in minimizing fiscal impacts, it could create political problems, and may not be feasible without statutory changes. If revenue sharing among states proves infeasible, sharing among areas in one state might be more workable, particularly in Nevada between the Lake Tahoe Basin and Carson Valley areas. (It should be noted that the fiscal analysis done for this EIS has not identified specific needs for revenue sharing measures.) Such a scheme could go far in reducing the rivalry for tax base and in permitting other kinds of development criteria, including environmental criteria, to carry more weight.

Effectiveness. Additional study is required before the extent of the effectiveness of such measures can be fully evaluated.

Responsibility. The initiative to study the need for such measures and to identify a workable system could be taken by federal, state, and/or regional agencies. Responsibility for implementation would be determined as a part of this study.

Cost. Cannot be determined until specific needs are assessed.

Timing. Study could begin as soon as facility plan alternative is chosen.

6. Coordinate regional land use planning and capital facilities planning and budgeting.

Description. This measure seeks to integrate land use and financial planning so that growth of public investments is commensurate with population and land use changes.

Effectiveness. Such measures are of limited effectiveness in most south shore areas, as major land use planning and infrastructure decisions have already been made. Where revisions and updates permit an evaluation of distribution and level of future service requirements, costs may be anticipated and minimized.

Responsibility. TRPA, CTRPA, county planning departments, service agencies.

7. Require developers to provide infrastructure and major service facilities and to contribute funds for such improvements.

Description. Developers, as part of the permit approval process, could be required to provide the public services needed to serve future residents. Per-unit public service costs could be reduced if infrastructure and capital facilities are included in private sector costs of development.

Effectiveness. Limited in that much of the vacant land is already subdivided and will not be developed in large enough projects to support such improvements. Such measures conflict with housing affordability goals.

Responsibility. TRPA, CTRPA, service agencies, county planning departments.

8. Consolidate service districts.

Description. Consolidation of service districts could improve efficiencies through shared administrative and planning functions. Consolidation could also be used to match districts with complementary problems, thereby strengthening their combined ability to raise capital or to collect revenues. Such measures could be effective in special problem situations.

Effectiveness. See "Description" above.

Responsibility. Service agencies.

Timing. As needed.

9. Institute double sessions or year-round school operations to reduce need for additional school facilities.

Description. Double session and year-round school operations would reduce need for additional schools to accommodate increased enrollments, and would thereby reduce or defer new capital expenditures. The per-unit fixed costs of operating school facilities would be lowered, but the per-unit variable costs (including personnel costs) would remain constant if student-teacher ratios are to remain constant.

Effectiveness. As variable operating costs are most of the total school costs, the overall cost reduction resulting from a double session or year-round school schedule may not be significant.

Responsibility. Local school districts.

Cost. See "Effectiveness" above.

10. Use volunteer personnel for law enforcement and fire protection.

Description. The use of volunteer personnel may result in lower per-unit service costs, although the use of full-time, paid personnel may be more desirable, especially if permanent staffing results in quicker response times, improved insurance ratings, and lowered insurance premiums. Volunteer personnel could then be used more efficiently during peak-demand periods.

Effectiveness. Limited, except in peak demand periods.

Cost. Would include the cost of training volunteers; could result in reduced per-unit service costs.

Timing. As needed.

Solid Waste

11. Expand the transfer station in the city of South Lake Tahoe.

Description. The South Tahoe Refuse Company proposes to construct an additional door where packer trucks can unload and to expand the storage area to accommodate expanded recycling.

Effectiveness. Present inefficiencies in design of the station allow the compactor to operate only 3.5 hours per day. Hypothetically, modifications that allow the compactor to be used two more hours per day mean the transfer station could handle as much as 293,095 cubic yards per day--more than enough to accommodate volumes projected under Scenarios 1 through 3. Proposed modifications would also alleviate traffic problems.

Responsibility. South Tahoe Refuse Company would implement, subject to CTRPA approval.

Cost. Specific information on the scale and cost of expansion is not available at this time.

Timing. The station is already operating near capacity and should be allowed to expand in a timely manner to accommodate future volumes.

12. Encourage recycling and resource recovery efforts by the solid waste franchise operator.

Description. The state of California goal for recycling and resource recovery is to achieve 25 percent reduction in waste going to the landfill. South Tahoe

Refuse Company estimates that, with approval of its expansion plans, it can triple cardboard tonnage; achieve a 15 to 25 percent increase in the recovery of aluminum, non-ferrous metals, batteries, electric motors, cast iron, steel, and appliances; and possibly begin recycling newsprint and glass. With a 25 percent reduction in volume under Scenario 1, the number of transfer trailer trips would drop from 9 to 7, and the number of landfill acres used would decrease from 5.7 to 4.3.

Effectiveness. Would depend on expansion of transfer station.

Responsibility. South Tahoe Refuse Company.

Cost. Savings would accrue from reductions in transfer trailer trips, the volume of waste deposited, and person-hours. These must be balanced against cost increases associated with the separation, storage, and transportation of recycled wastes.

Timing. Before investing in recycling equipment, South Tahoe Refuse Company should investigate markets for recycled goods and the feasibility of undertaking such an effort on a regional basis. The Solid Waste Management Plan recommends implementing a regional resource, conservation, and recovery program by 1985.

13. Initiate public education and volunteer programs to reduce amount of solid waste generated, promote a clean, litter-free community, and achieve the state goal of a 25 percent reduction in waste going to the landfill.

Description. The Solid Waste Management Plan calls for the establishment and implementation of continuing public and industry information and litter control programs in 1979.

Effectiveness. Waste reduction would depend on how actively the programs are promoted.

Responsibility. Local governments, chambers of commerce, citizen action groups, schools, private businesses.

Cost. No cost to the local government if conducted on a volunteer basis. Only costs are those associated with publicity and education.

Timing. Can be initiated immediately.

14. Construct transfer station in Nevada.

Description. Problems of congestion and capacity at the transfer station in the city of South Lake Tahoe could be alleviated by building another transfer station in Douglas County. South Tahoe Refuse Company would, however, continue to make collections as it does now.

Effectiveness. Douglas County contributes roughly 10 percent of the solid waste handled at the present transfer station. Assuming that this volume is transferred through the new transfer station, congestion around the existing facility would be reduced. This measure would be particularly useful under Scenarios 4 and 5, when high growth is projected for Douglas County. Building another transfer station would not, however, reduce the volume collected or the acres of landfill used.

Responsibility. South Tahoe Refuse Company.

Cost. Undetermined.

Timing. Feasibility of another transfer station should be studied by TRPA, CTRPA, and the local governments and conducted as part of county update of the Solid Waste Management Plan. Study would consider most efficient and cost-effective location, energy and transportation costs, and appropriate size.

5. UTILITIES

EXISTING CONDITIONS

Water

Water to the Lake Tahoe Basin is delivered to consumers by a number of purveyors. The service areas and the amount of water used on the California side of the south shore of Lake Tahoe Basin are shown in Tables D-28 and D-29. Douglas County figures for the Lake Tahoe Basin are shown in Table D-30.

Energy

In the Lake Tahoe Basin, the expansion of year-round recreational facilities has rapidly increased the demand for energy. During the early boom period of ski resort and casino development, power outages were not uncommon, but today, because of the importance of the tourist industry, a sufficient and reliable energy supply is critical to the economy of the basin.

Almost all energy consumed is imported from outside the basin. Only the emergency units of essential services and the casinos and a generating unit at King's Beach produce electricity within the basin. These units could not supply the rest of the basin in a major power outage. Environmental considerations such as air quality, water quality, and aesthetics limit the availability and type of energy that can be used. For example, the CTRPA Regional Plan would protect the region's air quality by reducing the use of fossil fuels because they contain large amounts of sulphur and lead.

Electricity, natural gas, and liquefied petroleum gas account for nearly 60 percent of the energy consumed in the basin and almost all energy used for space heating (see Table D-31).

Other energy sources in the basin are fuel oils and transportation fuels. Fuel oils are used primarily by rural residents for space heating, lighting, and cooking.

TABLE D-28

SOUTH TAHOE ZONE C MUNICIPAL AND DOMESTIC WATER USE AREAS

Water Use Areas	Total Water Use (AFA) Present Average	Total Water Use (AFA) Maximum Historical Year
A. Municipal Water Systems		
STPUD Service Area	3964	4024 (76)
Lakeside Service Area	389	527 (74)
Tahoe Keys Service Area	556	600 (77)
Lukins Service Area (UVA)	334	328 (76)
Angora Service Area	650	594 (76)
TPW & G Service Area	614	586 (76)
Misc. Private Well Users	490	500 (76)
B. Sewered Domestic & Recreational Systems		
N. Fallen Leaf Lake Area	107	122 (76)
Misc. Sewered Areas	49	52 (76)
C. Non-Sewered Domestic and Recreational Systems		
S. Fallen Leaf Lake Area	41	41 (76)
Echo Lake Area	17	31 (70)
Misc. Non-Sewered Areas	26	26 (76)
Total	7237	7431

Source: SWRCB, Draft: Water Use and Water Rights Lake Tahoe Basin, Section III.

TABLE D-29

SOUTH TAHOE ZONE C MONTHLY, FOUR-YEAR AND PRESENT AVERAGE WATER DIVERSION FOR MUNICIPAL AND DOMESTIC USE (MILLIONS OF GALLONS)[1]

	1974	1975	1976	1977	Present Average
J	122.9	136.4	142.4	146.3	147.4
F	113.2	136.8	142.6	133.8	142.4
M	113.8	113.5	151.8	138.5	145.8
A	125.1	126.7	164.8	133.8	149.8
M	173.4	186.3	222.8	146.4	198.1
J	258.4	251.2	279.0	206.2	262.0
J	272.0	301.4	294.2	277.9	311.4
A	285.6	271.0	248.9	293.2	299.2
S	205.3	205.4	211.2	214.2	226.8
O	153.2	151.7	167.8	162.2	173.6
N	122.2	135.2	142.2	129.6	143.9
D	137.8	144.4	138.7	133.9	151.6
	2070.3 (6356 AFA)	2179.2 (6690 AFA)	2299.7 (7060 AFA)	2110.6 (6480 AFA)	2356.3 (7234 AFA)

Present Maximum Annual Water Use[2] = 7429 AFA

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[1] Excludes Bijou Golf Course, Lake Tahoe County Club, Tahoe Paradise Golf Course, Pasture Irrigation and Livestock watering.

[2] Based upon water use for 1975 which is expanded according to the present (1977) level of development.

Source: SWRCB, Draft: Water Use and Water Rights Lake Tahoe Basin, Section III.

TABLE D-30

HISTORIC WATER USE NEVADA/TAHOE BASIN BY WATER SYSTEMS

	1966	1967	1968	1969	1970	1971	1972	1973
Douglas County								
Kingsbury Water Co.	238.3	249.1	317.7	333.7	348.9	355.5	407.7	445.2
Edgewood Water Co.	316.4	349.7	345.5	367.4	408.3	411.2	514.9	535.9
Round Hill Gen. Imp. Dist.	75.2	61.2	84.6	93.4	109.9	108.3	133.8	147.9
Elk Point Country Club	10.9	40.3	35.6	40.3	40.3	40.3	40.3	40.3
U.S. Forest, Nev. Beach	2.4	3.0	2.8	3.2	7.0	5.5	5.5	5.5
Nevada 4-H Camp	4.2	4.2	4.2	3.3	5.1	1/	1/	1/
Camp Galilee	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Presbyterian Conf. Point	17.9	19.5	10.9	10.9	10.9	10.9	10.9	10.9
Zephyr Cove Water Co.	53.4	55.0	55.0	55.0	116.2	160.7	138.2	138.2
Zephyr Cove Lodge	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5
Skyland Water Co.	67.1	67.1	67.1	67.1	93.9	93.9	93.9	93.9
Eickmeyer Water Co.	2.6	2.6	2.6	2.6	2.6	2.6	12.0	12.0
Snug Harbor Water Co.	1.2	1.2	2.7	2.7	2.7	2.7	2.7	2.7
Zephyr Cove Schools	17.7	17.7	17.1	18.0	17.5	18.3	18.4	18.6
Zephyr Cove Fire Sta.	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Cave Rock Water Co.	15.9	18.3	21.1	24.3	28.7	31.4	32.4	30.5
Logan Creek Water Co.	1.8	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Glenbrook Co.	121.9	121.9	121.9	121.9	121.9	121.9	121.9	121.9
S. Tahoe Prop. Utility Co.	-	-	-	-	13.1	13.1	13.1	13.1
Totals	976.1	1,042.6	1,121.3	1,176.3	1,362.7	1,408.8	1,578.2	1,649.1

1/ Now served by Kingsbury Water Co.

	1966	1967	1968	1969	1970	1971	1972	1973
Carson City	Nil							
Washoe County								
State Park	0.4	0.5	0.8	0.6	0.7	0.8	5.9	6.6
Incline Vil. Gen. Imp. Dist.	705.1	791.5	953.9	1,111.5	1,194.2	1,393.1	1,695.9	1,676.9
Crystal Bay Water Co.	11.4	11.4	11.4	11.4	28.9	28.9	28.9	28.9
Incline Beach Assoc.	5.0	9.5	5.0	5.0	5.0	5.0	5.0	2/
Total	721.9	812.9	971.1	1,128.5	1,228.8	1,427.8	1,730.7	1,712.4
Irrigation*								
Glenbrook	529.6	529.6	529.6	529.6	529.6	529.6	529.6	529.6
Bourne	149.3	149.3	149.3	149.3	149.3	149.3	149.3	149.3
Whittell	159.9	159.9	159.9	159.9	159.9	159.9	159.9	159.9
Park	226.3	226.3	791.0	791.0	791.0	791.0	791.0	791.0
Rabe	150.0	150.0	150.0	150.0	-	-	-	-
Total	1,215.1	1,215.1	1,779.8	1,779.8	1,629.8	1,629.8	1,629.8	1,629.8
Residences not served by Water Company	78.6	78.6	78.6	78.6	78.6	78.6	82.5	86.6
Sub-total	2,991.7	3,149.2	3,950.8	4,163.2	4,299.9	4,545.0	5,021.2	5,077.9
California								
So. Side Utility	144.5	138.8	114.8	170.5	109.9	110.7	114.3	113.8
N. Tahoe P.U.D.	132.5	185.0	82.0	110.2	179.4	468.9	489.4	497.3
Total	277.0	323.8	196.8	280.7	289.3	579.6	603.7	611.1
Grand Total	3,268.7	3,473.0	4,147.6	4,443.9	4,589.2	5,124.6	5,624.9	5,689.0

Source: Brian A. Randall, Appendix VI Report of Study of Water Filing and Diversions in the Lake Tahoe Basin, Nevada, September 1978.

*Irrigation figures represent maximum allowed diversion, not actual diversion amounts.

TABLE D-30 (Continued)

Douglas County	1974	1975	1976	1977
Kingsbury Water Co.	521.2	623.1	626.2	624.8
Edgewood Water Co.	529.4	576.7	603.8	622.4
Round Hill Gen. Imp. Dist.	162.2	176.3	185.5	176.3
Elk Point Country Club	40.3	40.3	40.3	40.3
U.S. Forest, Nev. Beach	5.5	5.5	5.5	5.5
Nevada 4-H Camp	1/	1/	1/	1/
Camp Galilee	1.0	1.0	1.0	1.0
Presbyterian Conf. Point	10.9	10.9	10.9	10.9
Zephyr Cove Water Co.	131.9	139.2	151.8	168.4
Zephyr Cove Lodge	27.5	27.5	27.5	27.5
Skyland Water Co.	84.0	89.6	127.2	127.6
Eickmeyer Water Co.	12.0	12.0	12.0	12.6
Snug Harbor Water Co.	2.7	2.7	2.7	2.7
Zephyr Cove Schools	18.6	18.6	18.6	18.6
Zephyr Cove Fire Sta.	0.7	0.7	0.7	0.7
Cave Rock Water Co.	31.2	30.5	37.7	37.3
Logan Creek Water Co.	3.3	3.3	3.3	3.3
Glenbrook Co.	121.9	121.9	121.9	121.9
S. Tahoe Prop. Utility Co.	13.1	13.1	13.1	13.1
TOTALS	1,717.4	1,892.9	1,989.7	2,014.9

1/ Now served by Kingsbury Water Co.

Carson City	Nil			

Washoe County	1974	1975	1976	1977
State Park	5.3	5.3	6.7	7.6
Incline Vil. Gen. Imp. Dist.	1,842.4	1,861.7	1,842.6	1,790.0
Crystal Bay Water Co.	30.4	30.4	30.4	30.4
Incline Beach Assoc.	2/	2/	2/	2/
Washoe Co. S.I.D. #1	3/	3/	333.3	190.48
TOTAL	1,878.1	1,897.4	2,212.8	2,018.5

2/ Served by Incline Village G.I.D.

3/ Served by North Tahoe P.U.D. to May 1, 1975

Irrigation	1974	1975	1976	1977
Glenbrook	529.6	529.6	529.6	529.6
Bourne	-----	-----	-----	-----
Whittell	-----	-----	-----	-----
Park	791.0	791.0	791.0	791.0
Rabe	-----	-----	-----	-----
TOTAL	1,320.6	1,320.6	1,320.6	1,320.6
Residences not served by Water Company	90.7	95.2	100.0	105.0
Sub-total	5,006.8	5,206.1	5,623.1	5,459.0

California	1974	1975	1976	1977
So. Side Utility	177.0	284.1	281.8	261.3
N. Tahoe P.U.D.	509.6	429.9	4/	4/
TOTAL	686.6	714.0	281.8	261.3

4/ Served by Washoe County S.I.D. #1 as of May 1, 1975

	1974	1975	1976	1977
GRAND TOTAL	5,693.4	5,920.1	5,904.9	5,720.2

TABLE D-31

ENERGY USED, 1976: LAKE TAHOE BASIN

Energy Sources	Quantity Used	Quantity Used in 1000 BTUs	Percent of Total Consumption
Electricity	455,958,000 kWh	1,556,184,664	16.71
Natural Gas	3,225,000 Mcf	3,386,250,000	36.36
LPG	6,500,000 gal	604,500,000	4.81
Fuel Oils	3,200,000 gal	448,000,000	4.81
Gasoline	24,738,300 gal	3,091,050,585	33.20
Jet Fuel	196,359 gal	26,508,465	0.28
Aviation Gasoline	183,902 gal	22,803,848	0.24
Boating Fuel	100,000 gal	19,000,000	0.14
Diesel Fuels (for buses)	120,654 gal	16,891,560	0.18
(for trucks)	2,500,000 gal?	35,000,000	0.38
(for SPPC's plant)	50,000 gal	7,000,000	0.08
Wood	6,500 cords	104,000,000	1.12

Source: CTRPA, An Analysis of the Carrying Capacity of the California/Tahoe Region: Energy Element, November 1977.

Transportation fuels used by automobiles, trucks, aircraft, and power boats account for more than a third of the energy consumed in the basin.

On a per capita basis, the consumption of electricity, natural gas, and liquefied petroleum gas is higher in the basin than in other areas of California. In 1976 average use of natural gas by basin residents in El Dorado County was 138.43 thousand cubic feet; the average in California was 103.2 thousand cubic feet. The higher energy use in the basin can be attributed to the greater demand for space heating in winter.

Electricity. The Sierra Pacific Power Company, with headquarters in Reno, supplies all of the basin's electrical energy. Fuel to generate electricity comes from fuel oil, natural gas, and electricity, all of which is imported from outside the basin.

Sierra Pacific Power Company serves both the south shore and north shore areas. In 1976 there were 32,000 customers in the Lake Tahoe Basin, of which nearly 80 percent were on the California side. Total consumption for the year equalled 455,950,000 kilowatt hours. Locations of generating and transmission facilities are shown on Figure D-34.

Harsh weather is the main threat to a reliable supply of electricity. Severe winter weather can cause transmission and distribution failures and may cause power outages in some service areas. In the past, outages have been short and have not affected large operations, such as hospitals, ski resorts, casinos, or the facilities of STPUD, which have their own emergency generating systems.

A measure of the adequacy of the supply system is its reliable capacity; that is, the capacity of the system assuming the loss of its largest component. The total capacity of the south shore system is 105,070 kilowatts; the reliable capacity of the system is 56,000 kilowatts, and Tables D-32 shows the capacity of the electrical supply system. Table D-33 shows the derivation of reliable capacity for the south shore. In 1976 the average in-basin demand for the south shore service area was 34,430 kilowatts, a 35 percent increase over 1970. The highest ever peak demand, which occurred in the winter of 1977-1978, was 70,000 kilowatts, a figure which exceeds the system's reliable capacity by 14,000 kilowatts.

Before facilities can be expanded, Sierra Pacific is required to submit an environmental impact report that outlines possible adverse effects of the project and suggests measures to mitigate these impacts. In addition, the facility is subject to the regulations of the California Public Utilities Commission if its operating voltage exceeds 200 KV, and the lines are subject to regulation by the Nevada Public Service Commission when the size exceeds 60 KV. The largest transmission line in the basin is 120 KV.

Before CTRPA approves any project, it requires the utility to prepare a master plan and an EIR presenting the facilities that would be required over the time frame of the plan. Sierra Pacific is preparing such a plan, and until such time as it receives CTRPA's approval, it cannot construct any projects.

TABLE D-32

SOUTH SHORE ELECTRICAL SUPPLY SYSTEM

Distribution Facilities

SUBSTATION		SIZE	CAPACITY	EMERGENCY CAPACITY[1]
Glenbrook	- Unit #1	60/14.4 kV	3,000 kW	3,750 kW
Round Hill	- Unit #1	120/14.4 kV	28,000 kW	35,000 kW
Stateline	- Unit #1	60/14.4 kV	10,000 kW	12,500 kW
	Unit #2	60/14.4 kV	10,000 kW	12,500 kW
	Unit #3	60/14.4 kV	5,000 kW	6,250 kW
	Unit #4	60/14.4 kV	14,000 kW	17,500 kW
Meyers	- Unit #1	120/14.4 kV	26,670 kW	33,338 kW
	Unit #2	120/14.4 kV	22,400 kW	28,000 kW

Transmission Facilities

LINE NO.	LINE	SIZE	CAPACITY
#624	Carson-Glenbrook	60 kV	17,000 kW
#112	Buckeye-Round Hill	120 kV	146,000 kW
#634	Buckeye - Stateline	60 kV	25,000 kW
#111	Buckeye - Meyers	120 kV	110,000 kW
#640	Meyers - Stateline	60 kV	55,000 kW[2]

Notes: The size of the facilities, indicated in the table, is the operating voltage. For the distribution facilities, there is a second figure which represents the actual voltage distributed to the household from the transformers.

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[1] Transformers can perform up to 25 percent of their rated capacity for short periods of time before the loss of their lives.

[2] Tie-lines are not counted in normal system capacity.

Source: Sierra Pacific Power Company, South Lake Tahoe Area Electrical Supply Study, July 1975.

Figure D-34 ENERGY SUPPLY

ELECTRICAL SUPPLY SYSTEM

●	GENERATION STATION
▲	SUBSTATION
▬	120 KV LINE
—	60 KV LINE
□	TRANSMISSION SWITCHING STATION

LINES

629	TRUCKEE - TAHOE CITY
650	TRUCKEE - BROCKWAY
123	BRUNSWICK - INCLINE
625	TAHOE CITY - KING'S BEACH
624	CARSON - GLENBROOK
634	BUCKEYE - STATELINE
111	BUCKEYE - MEYERS
640	MEYERS - STATELINE

NATURAL GAS SUPPLY SYSTEM

○	PRESSURE LIMITING SYSTEM
□	MEASUREMENT STATION
△	RESALE METER & PRESSURE LIMITING STATION
—	SERVICE AREA BOUNDARY

LINES ═□═

1	CARSON CITY - KINGSBURY GRADE
2	KINGSBURY GRADE
3	KINGSBURY GRADE - CAVE ROCK
4	CARSON CITY - INCLINE VILLAGE
5	INCLINE VILLAGE - MT. ROSE
6	INCLINE VILLAGE - TAHOMA

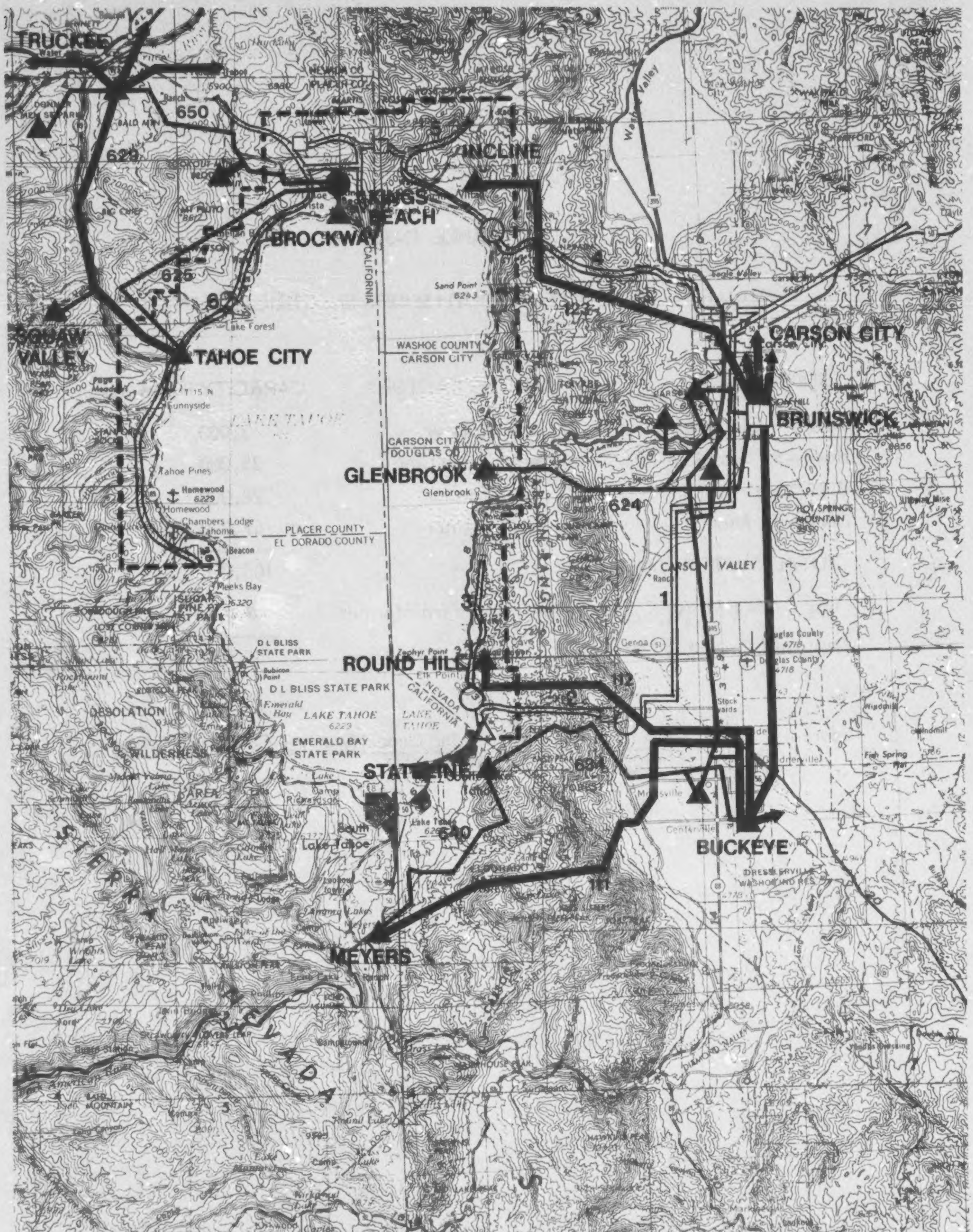
TRUCKEE
650
629
INCLINE
KINGS BEACH
BROCKWAY
625
SQUAW VALLEY
TAHOE CITY
CARSON CITY
BRUNSWICK
123
4
GLENBROOK
624
CARSON VALLEY
1
3
ROUND HILL
112
2
STATELINE
684
640
BUCKEYE
111
MEYERS
LAKE TAHOE
WASHOE COUNTY
CARSON CITY
DOUGLAS CO
PLACER COUNTY
EL DORADO COUNTY
NEVADA
CALIFORNIA
D L BLISS STATE PARK
EMERALD BAY STATE PARK
DESOLATION WILDERNESS AREA
HOT SPRINGS MOUNTAIN
South Lake Tahoe
Glenbrook
Homewood
Tahoe Pines
Sunnyside
Lake Forest
Meeks Bay
Zephyr Point
Elk Point
Genoa
Minden
Centerville
Gardnerville
DRESSLERVILLE WASHOE IND RES
SIERRA NEVADA

TABLE D-33

RELIABLE CAPACITY FOR SOUTH SHORE ELECTRICAL SUPPLY

SUPPLY LINK	LIMITING FACTOR	CAPACITY (kilowatts)
Carson - Glenbrook	Transformer	3,000
Buckeye - Stateline	Transmission Line	25,000
Buckeye - Round Hill	Transformer	28,000
Buckeye - Meyers	Transformer	49,070
TOTAL SYSTEM CAPACITY		105,070
less LARGEST RISK = Buckeye - Meyers transformer		- 49,070
RELIABLE CAPACITY		56,000

Source: CTRPA; An Analysis of the Carrying Capacity of the California/Tahoe Region: Energy Element, November 1977.

Peak demand projections for the five growth scenarios are based on population growth. The following formula is used to calculate demand:

$$\text{Peak demand (MW)} = (\text{Peak demand 1978}) + (\text{Peak demand 1978}) \times \frac{(\text{Projected pdp}) - (\text{pdp 1978})}{(\text{pdp 1978})}$$

where peak demand = the non-coincident demand for the 1977/1978 winter/summer seasons. Based on data obtained from the Sierra Pacific Power Company, peak demand for STPUD was 62.3 MW and for DCSID, 14.2 MW.

pdp = peak day population, as

estimated by Recht-Hausrath & Associates.

The following table shows pdp by district for each scenario.

		Growth Scenarios				
	1978	1	2	3	4	5
STPUD	91,080	103,890	140,330	125,500	104,380	143,700
DCSID	19,360	29,670	30,350	49,750	77,350	68,470

These estimates do not include day visitors.

Natural Gas. Natural gas is supplied by the Southwest Gas Corporation, which distributes it to the north, east, and west shores of the lake. The company also provides natural gas to CP National, which serves the California portion of the south shore. Transmission lines and other facilities are shown on Figure D-34.

To determine the adequacy of the natural gas system, the capacity of the pipelines is compared to the customer demand. The capacity of the system, or the supply, is a function of the pipe size and the pressure in the pipe. Over a short time period, the capacity may be considered constant. However, demand varies directly with the number of customers and the degree day deficiency (DDD), an index of how cold it is. At a 70° day deficiency, the system capacity is inadequate to satisfy customer demand. This situation occurs whenever the average daily temperature is below -5°. The following example will illustrate the DDD concept.

Recorded high temperature for the day = 40°F
Recorded low temperature for the day = 20°F
Average Temperature = $(40^{\circ} + 20^{\circ}) \div 2 = 30^{\circ}$F
Degree Day Deficiency = (average temperature) - (65°F)
$= 30^{\circ} - 65^{\circ} = -35^{\circ}$

If the average temperature for the day was 10°, the DDD would be 55°. Based on population projects for each of the service areas and the design criterion of deficiency, system capacity would have to be expanded around 1981. (Jauregui, pers. comm.).

In 1976 peak demand for any one day in the south shore service area of CP National (formerly known as California-Pacific Utilities Company) was 8,600 thousand cubic feet (mcf). By 1978 peak demand for natural gas in this area had grown to 10,041 mcf. In the Nevada portion of the south shore, served by the Southwest Gas Corporation, peak demand in 1976 was 4,853 mcf. Although 1978 figures are not available, a large increase in demand, similar to that of the California portion probably occurred. Southwest Gas officials feel gas supplies are adequate until the winter of 1980-1981. At that time peak demands are expected to equal, if not surpass, the capacity of the system. Currently, the design capacity of the system is exceeded two to five times per year (Jauregui, pers. comm.).

Demand calculations for natural gas in STPUD for the five growth scenarios are based on daily average per capita consumption figures and are computed according to the formulas below:

(1) Total demand = residential demand + commercial demand

where residential demand = 76.9% of total demand, as estimated from CTRPA figures.

(2) Residential demand = (projected population) X (per capita consumption)

where projected populations = permanent residents only and are presented in Appendix Tables A-5 through A-9.

per capita consumption = 0.379 thousand cubic feet per day, from CTRPA estimates.

Demand calculations for DCSID reflect residential demand only and are computed according to formula (2) above. For the Upper Carson River Basin, calculations represent the increase in demand due to spillover population only. Spillover population increases are roughly estimated by Recht-Hausrath & Associates as follow:

	Growth Scenarios				
	1	2	3	4	5
Increase of spillover population between 1978 and 2000	4,272	3,450	7,200	21,367	18,979

Liquefied Petroleum and Other Energy Sources. Liquefied petroleum gas (LPG) includes propane, butane, and propane-butane mixtures. Accounting for over 6 percent of the energy consumed in the basin, LPG is used primarily in rural areas. Like other energy sources, LPG is imported from outside the basin. Five companies operate within the basin to serve 8,000 LPG customers. Customers purchase the fuel in bulk from local suppliers, who receive regular shipments or who can order more as needed.

MITIGATION MEASURES

Energy

Physical Techniques: Electricity

1. Make needed improvements to the electrical supply system.

Description. The following projects to improve the electrical supply system were identified by SPPC in 1975:

Year	Project	Cost
1976	construct Round Hill to Stateline line	$334,000
1978	replace Meyers 60 kV regulator	61,000
1979	convert Round Hill to Stateline line to 120 kV operation	92,000
1979	relocate Round Hill 60 kV regulator to Stateline	69,000
1979	install 120/14.4 kV transformer at Stateline	330,000
1980	rebuild Meyers to Stateline line at 120 kV	913,000
1981	install 120/14.4 kV transformer unit at Stateline	379,000
1982	install 120/14.4 kV transformer at Stateline	410,000

Effectiveness. Would be highly effective in increasing system reliability and capacity; projects would be subject to permit approval and EIR process (in California).

Responsibility. Sierra Pacific Power Company.

Cost. See list of projects above.

Timing. See list of projects above.

Physical Techniques: Natural Gas.

2. Install 2300-foot, 8-inch pipeline parallel to existing pipeline that serves the California side of the south shore.

Description. Construction of this pipeline would remedy low pressure problems and increase capacity of the supply system from 20,000 to 21,000 mcfd into the basin and from 16,700 to 17,400 mcfd into the CP National service area.

Effectiveness. Would be highly effective in increasing system reliability and capacity; projects would be subject to permit approval and possibly EIR process (in California).

Responsibility. Southwest Gas and CP National.

Cost. $74,000.

Timing. Needed by 1979.

3. Construct a storage/peaking facility for LNG.

Description. Facility would store LNG during periods of low demand for later use during peak periods when demand may otherwise exceed supply.

Effectiveness. Would be highly effective in reducing risk of shortage.

Responsibility. Southwest Gas.

Cost. $20 million.

Timing. Southwest Gas must first obtain permits from regulatory agencies, including local governments, the Federal Energy Regulatory Commission, and the Nevada State Public Service Commission; facility could be expected to be in service by 1981-1982.

Energy Conservation Techniques.

4. Retrofit existing structures with additional insulation.

Description. Local building inspectors would determine the amount, coverage, and type of insulation that would best achieve a specific level of thermal efficiency. Insulation could be required upon resale of the property or within a specified time period. Retrofitting would only be required if it would result in a net savings to the property owner.

Effectiveness. Would reduce peak winter loads. Actual energy savings would depend on when homes and businesses are retrofitted and how much more insulation is required.

Responsibility. Property owners, local building inspectors.

Cost. Would depend on amount of additional insulation required. Loan and subsidy programs could be established to assist those unable to afford modifications. California Community Energy Conservation Grants are a possible source of funds. Additional building inspectors may be required.

Timing. Before implementation, local governments must demonstrate that local conditions warrant variation from the Uniform Building Code, that the requirement is reasonably tied to public health or safety interests, and that a reasonable relationship exists between these interests and individual costs.

5. Revise building codes to require additional insulation of walls, floors, ceilings, attics.

Description. All new construction would be required to comply with the new standards.

Effectiveness. Would reduce peak winter demand, especially for space heating. Energy savings would depend on how much additional insulation is required.

Responsibility. Local building departments.

Cost. Some cost to local governments to revise codes. Administrative costs would be minimal because procedures would be consistent with present inspection system. Costs to install additional insulation would also be minimal.

Timing. Before revising building code, local governments must demonstrate that local conditions warrant variation from Uniform Building Code. This may be easily accomplished because conditions in the Lake Tahoe Basin (8,200 heating degree days per year at Tahoe City) are much colder than conditions described in the regulations, which require all areas with more than 45,00 heating-degree days to insulate similarly.

6. Encourage energy audits.

Description. Utility companies plan their systems to accommodate peak demand. Energy audits would document energy consumption habits and could be used to suggest ways of conserving energy and of distributing loads more evenly throughout the day in order to reduce peak demand.

Effectiveness. Would depend on how well publicized the program is, how many property owners take advantage of the program, and how closely they follow the advice of the energy analysis consultants.

Responsibility. Sierra Pacific Power Company and property owners.

Cost. Service is free to property owners.

Timing. Already being offered.

7. Encourage development of energy-efficient transportation systems.

Description. Transportation systems--automobiles, trucks, airplanes, boats, etc.--are among the major consumers of energy resources. Expanded bus service, increased miles of bikeways, home mail delivery, and high altitude tuning of local vehicles are several of the many approaches to reducing vehicle miles traveled and slowing the demand for fuels.

Effectiveness. Would result in less energy consumed and provide a measure of insurance against future energy crises. Effectiveness depends heavily on getting users of private vehicles to use public transportation. Implementation of CTRPA's Regional Transportation Plan, for example, would reduce 1974 energy consumption levels 13 percent by 1995.

Responsibility. CTRPA, TRPA, and local governments.

Cost. Would depend on which approaches are selected. A basin user fee has been proposed that would shift the burden of implementing a transportation management system from the local residents onto all basin users.

Timing. Should be consistent with regional transportation plans and the states' air quality nonattainment plans.

6. CULTURAL, ARCHAEOLOGICAL, AND HISTORICAL RESOURCES

BACKGROUND

Ethnographic Background

Before American occupation, the Tahoe-Carson Valley area was the nuclear territory of the Washo, a Hokan speaking group. Washo territory extended from Honey Lake in the north to Sonora Pass in the south and from the western slopes of the Sierra Nevada to the Pine Nut Mountains in the east (see Figure D-35). Lake Tahoe was the center of the Washo world, and each spring the entire tribe gathered at "Da ow a ga."

Within the Washo territory, the climate and geography varied widely from the arid Great Basin to the lush western slopes of the Sierra Nevada. The territory included high, snow-covered mountains, fertile valleys, and high desert. Each geographical area provided different resources, and the Washo knew their land well. Nomadic hunters and gatherers, they traveled from one area to another as the seasons changed and different resources became available. They wintered in the Great Basin and moved into the mountains in the spring to hunt, fish, and gather spring annuals. In the fall, they gathered acorns and pinyon nuts.

The extended family group or household was the basic Washo social-economic unit. As soon as travel became possible in the spring, family groups of seven to thirteen members would leave the winter village to establish base camps for hunting, fishing, and plant gathering (Kroeber, 1925). This nomadic life ended in the late 1800s, when increased contact with the white man forced the Washo to settle near towns and farms to work as laborers and traders.

Archaeological Background

The north-central Sierra Nevada was first surveyed by Heizer and Elsasser in 1953. According to their observations, the prehsitoric land-use patterns for the area fell into separate time periods: The Martis Complex and the Kings Beach complex. The earliest, the Martis complex dates from 1000 B.C. to A.D. 500. The artifacts that characterize this period are large basalt projectile points and atlatl weights. Sites are usually along game trails and in seed-gathering areas. The Kings Beach complex dates from A.D. 500 to the ethnographic Washo and is characterized by small chert and obsidian projectile points. The sites are primarily along small tributaries rather than major streams. The sites and artifacts indicate a fishing/seed gathering economy.

Recent excavations near Spooner Lake indicate occupation of the area as early as 5000 B.C. and definitely by 3000 B.C. (Elston, 1971). The Spooner complex was succeeded by the Martis complex, with no distinct chronological break.

As archaeological work continues in the north-central Sierra Nevada, the prehistoric record becomes more complex, making the simple replacement hypothesis originally suggested for the area inadequate. Continued work will clarify the relationships between complexes and their interaction with the environment.

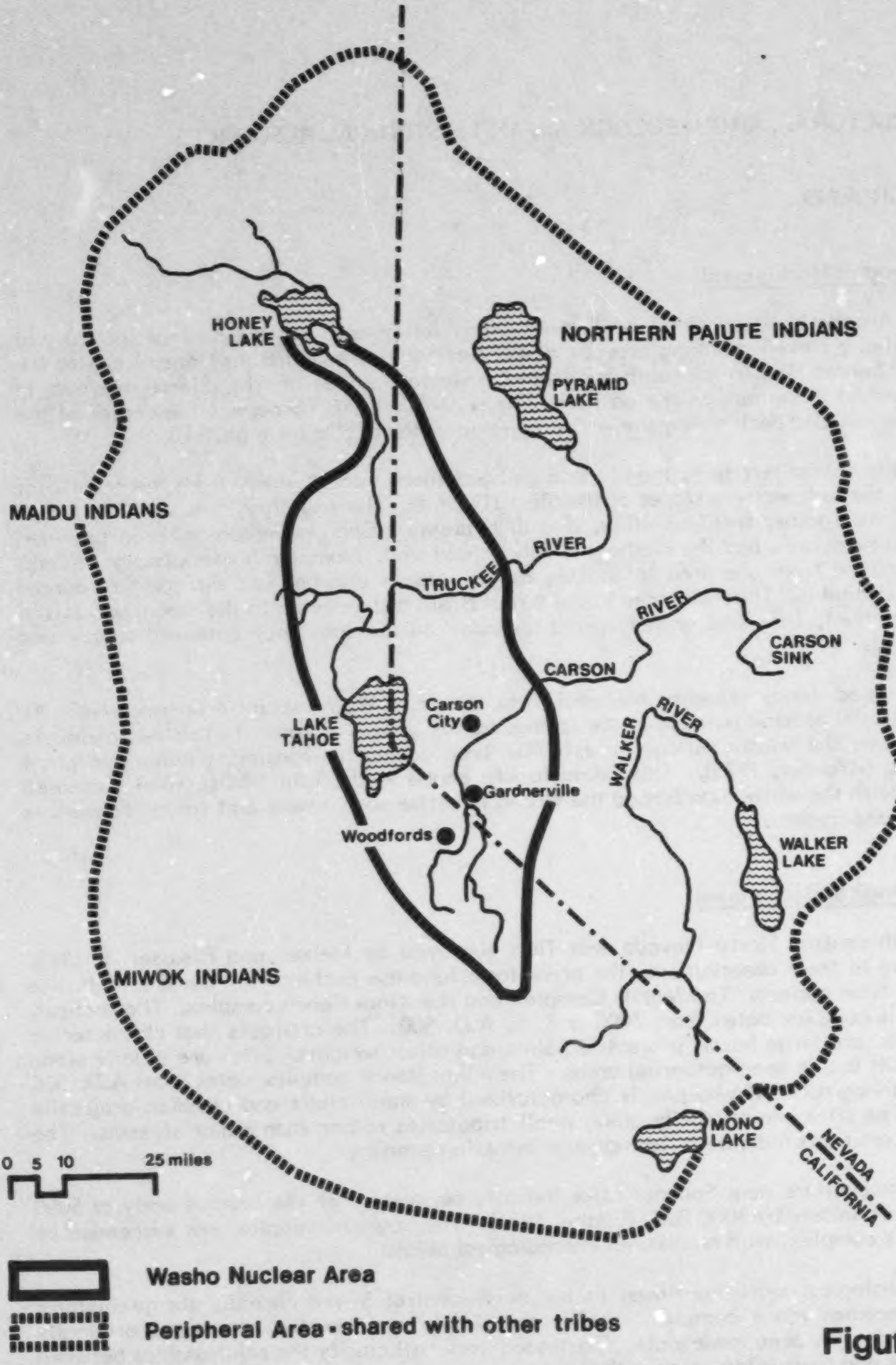

Figure D-35
WASHO TRIBAL TERRITORY

Historical Background

The historical development of the Lake Tahoe Basin and the surrounding area is directly linked with travel through this rugged section of the Sierra Nevada. Before the development of emigrant trails to California, few non-Indians traveled through the area. The first white men recorded in Washo territory were three fur trappers led by Jedediah Smith in 1826. Other trappers and explorers also passed through the area. The Bartleson-Bidwell party passed through the area on their way west in 1841, and in 1843 and 1844, John Charles Fremont led a government surveying expedition through the area.

In the middle of the nineteenth century, groups of emigrants began to replace the scattered traders and explorers. Wagon trains passed through the Tahoe area on their way to California where the travelers joined the gold rush or settled. By the mid-1850s, the Mother Lode of the Sierra Nevada was beginning to thin out, and fierce competition for possession of major east-west wagon road stations began. This generated surveying and tollroad construction. Many landmarks such as Yank's Station, Old Emigrant Road, and the Pony Express Remount Station at Woodfords come from this period.

When silver was discovered in the Nevada Comstock Lode in 1859, a reverse migration across the Sierra Nevada began. Toll stations, inns, trading posts, and roadhouses spread rapidly along the roads and passes most heavily traveled. Small ranches, farms, and dairies developed around the most prominent stations to supply food for the travelers. As traffic increased, the agricultural business expanded.

Hay grown in the meadow lands was harvested for horse and mule trains, and dairy and beef cattle grazed in the mountains during the summer. As the Comstock Lode became more industrialized, the farms, ranches, and dairies supplied the needs of the developing towns and mining communities. Logging became an important industry at this time. As the towns expanded and new mining innovations were made, the need for lumber increased. During this period, many sawmills and lumber companies were established around Lake Tahoe, and most of the virgin timber was cut before 1900.

As the area became more settled in the 1860s residents wanted to escape the heat and noise of the mining towns. It was during this period that a resort industry began around Lake Tahoe. Before this time, the lakefront lands had been off the main roads to the mining camps. Now inns that had served travelers on the toll roads began to cater to seasonal resort visitors. Many of the inns and toll stations began to resemble boarding houses, and the farms, dairies, and ranches supplied the seasonal lake visitors. The seasonal resort hotels flourished until the 1930s, when the California roads to the Lake Tahoe Basin were paved.

The principle automobile route was Route 50, which brought people to the south shore. Soon many small summer cabins and homes on small lots were clustered near the lake. After 1945, when modern snow-removal equipment became available, the Lake Tahoe Basin became accessible all year. The lake communities changed from seasonal resorts to year-round communities. Urban growth continued to accelerate, especially after 1955, when the year-round casinos at Stateline were established.

MITIGATION MEASURES

1. Require site analysis as part of the development or environmental impact review process.

Description. Site analysis for cultural resources could be carried out in a two step process. The first step would be to conduct a surface reconnaissance to identify surface evidence. The second step would be to conduct tests to determine the extent, depth, and cultural content of the site.

This requirement would allow the greatest amount of flexibility in mitigating adverse impacts on cultural resources because each project would be reviewed individually, and specific recommendations for mitigation would be made. These mitigation measures could include any of the potential measures listed above, and actions required could be to relocate the project, alter the location of certain structures, or excavate the site to recover significant data.

Effectiveness. Could be easily adapted into the existing permit application or EIS/EIR process.

Responsibility. In the case of the EIS/EIR process, the lead agency would be responsible for seeing that the cultural resources section of the environmental report is adequate. In the case of the development review process, the site analysis could be conducted by a trained person retained by the permit issuing agency, or the applicant could be required to submit, along with the development plan, a cultural resources report by a trained archaeologist.

Cost. Would be insignificant, as implementation and enforcement mechanisms already exist.

Timing. Given the number of known cultural resources and the high potential or discovering additional resources, this aspect of the permit process should be initiated as soon as possible.

2. Nominate cultural resources for inclusion in the National Register.

3. Require dedication of cultural resources by developer as part of subdivision process.

4. Purchase land or obtain restrictive easements to place sites in public possession.

Description. These measures are appropriate only if they are recommended as a result of a site analysis, as described above. In other words, they should be employed only after the extent and cultural content of the cultural resources have been well defined. If a development plan only partially affects the site of a cultural resource, then dedication of that area by the developer, purchase of an easement, or designation of deed restrictions controlling use of that area are effective approaches. If a site meets the criteria for nomination to the National Register of Historic Places, immediate steps should be taken to insure its preservation.

Effectiveness. These mitigation measures are well established and can be easily implemented.

Responsibility. Developers, local governments, archaeologists, local Native Americans, State Historic Preservation Office, Advisory Council on Historic Preservation.

Cost. Eligibility for the National Register would place constraints on development. Acquisition of the site through dedication would entail insignificant costs to local government. Acquisition through purchase would involve the cost of the land, plus legal costs to cover land transfer. Easements could effectively preserve the site at a much lower cost than direct acquisition. The developer of the property would likely incur additional costs depending on the extent to which the project encroaches upon the cultural resources.

Timing. Would depend on recommendations of the site analysis.

E. EXISTING NATURAL RESOURCES AND ENVIRONMENTAL QUALITY IN UPPER CARSON RIVER HYDROGRAPHIC BASIN

1. BIOLOGY

VEGETATION

Vegetational Communities

Conifer Forest. Montane coniferous forest occupies the western slopes of the basin. It occurs at elevations ranging from 5,000 feet (less than 500 feet above the valley floor) to 9,000 to 9,500 feet along the ridgeline of the Carson Range. At the lower elevations, the forest is dry and open, with Jeffrey pine (*Pinus jeffreyi*) dominating a sagebrush or chaparral understory. At around 6,000 feet, other conifers, including white fir (*Abies concolor*), incense cedar (*Calocedrus decurrens*), and western juniper (*Juniperus occidentalis*), became more prominent.

Although drier and more open growing, the montane coniferous forest of the Upper Carson River Basin is similar to the Jeffrey pine-yellow pine associations of the Lake Tahoe Basin and adjacent areas and provides similar wildlife habitat.

Sagebrush Steppe. The lower slopes of the mountains on both sides of the valley and, in undisturbed areas, the valley floor are covered with a treeless shrub community, dominated by sagebrush (*Artemesia tridentata*). Bitterbrush (*Purshia tridentata*), *Chrysothamnus nauseosus*, and *Happlopappus* are important associates, and balsamroot (*Balsamorhiza sagittata*), Mormon tea (*Ephedra viridis*), desert peach (*Prunus andersonii*), and a variety of herbaceous plants and grasses are also common.

Although sagebrush steppe does occur within the Lake Tahoe Basin, it is only on the Great Basin side that sagebrush becomes a prominent feature of the landscape. On the valley floor, many acres of former sagebrush have been cleared, irrigated, and cultivated as pasture or forage cropland.

Seral succession within the sagebrush steppe varies with the type of disturbance (Young *et*. *al*., 1977). Fire or disruption of the soil surface increases the proportion of root-sprouting plants, including *Chrysothamnus*, desert peach (*Prunus andersonii*), and *Purshia*. The latter is a most valuable browse species for domestic and native herbivores. *Artemesia* dominance is reduced.

Exclusion of fire or severe overgrazing by domestic or native animals encourage the spread of *Artemesia*, reducing the amount of favored browse. Conifer forests and pinyon and juniper woodlands invade unburned steppe along their common boundary. Weedy annuals, including Russian thistle or tumbleweed (*Salsola iberica*), an introduced pest species, completely invade the sagebrush steppe in places, particularly where there has been overgrazing, changing the long-term successional pattern of the community and eliminating more palatable and nutritious plants (Young, *et* al., 1977).

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In low areas, where the water table is near the surface, evaporation of seasonal ponds leaves soluble salts in the soil. Characteristic vegetation of these playas includes saltbrush (Atriplex spp.) and salt grass (Distichlis spicata var. stricta) (Taylor and Valum, 1974).

Pinyon and Juniper Woodland. Conifer forest is typical of Sierran slopes, but pinyon and juniper woodland characterizes the mountains and bajadas of the Great Basin. Pinyon pine (Pinus monophylla) and Utah juniper (Juniperus osteosperma) are the dominant species, with Jeffrey pine occurring at higher elevations. Understory in the pinyon and juniper woodland is a sagebrush steppe association.

The Pine Nut Mountains on the eastern edge of the study area are covered with this pinyon pine-Utah juniper association, from which their name was derived. At the southern end of the valley, where the headwaters of the Carson River lie in the Sierras, pinyon pine extends as far west as Hope Valley (Smith, 1973), but Utah juniper reaches its western limit just over the line into Alpine County, California, in the Pinyon-Juniper Natural Area (NA 020150: Hood, 1978; Young et al., 1977). Jeffrey pine, which grows in association with pinyon pine and Utah juniper at higher elevations in the Nevada hills, replaces Utah juniper in the Carson headwaters area. Lands surrounding Indian Creek Reservoir support pinyon pine-Jeffrey pine woodlands and sagebrush and bitterbrush understory.

The large, edible seeds of the pinyon pine are eaten by wildlife and humans. When growing in association with bitterbrush, a valuable browse plant, pinyon woodlands provide an exceptional food resource for wildlife.

Because pinyon and juniper woodlands grow in arid areas with a limited growing season, they have a slower revegetation rate following fire when compared with a more mesic cover type. The pinyon and juniper woodlands to the southeast of the study area (north of Topaz Lake) burned five years ago (Frantz, pers. comm.) and have produced little obvious regrowth to this time.

Streamside Vegetation. Several different types of streamside plant associations occur in the study area. Black cottonwood (Populus trichocarpa) and willow (Salix spp.) line the streams of the valley floor and have been planted or become naturalized along irrigation and diversion ditches. Understory plants are subject to heavy browsing in grazing areas and are often absent there.

Seeps and springs are more common on the Sierran slopes, but occur throughout the Pine Nuts Mountain as well. At these higher elevations, quaking aspen (Populus tremuloides) grows with a variable understory of willows, alder (Alnus sp.), serviceberry (Amelanchier sp.), and other shrubs. Aspen groves are often associated with wet meadows, which, while not as extensive or well-developed as the wet meadows of the Lake Tahoe Basin, have similar value to wildlife.

Streams at the southern end of the basin flow out of the Toiyabe National Forest. In this region, around Hope Valley, Diamond Valley, and elsewhere, the streamside plants are more typically Sierran, with black cottonwood, aspen, and mountain alder (Alnus tenuifolia) growing in association with a mix of conifers and variable herbaceous plants and shrubs. Because of the greater amount of available moisture, meadows are more typical in this area than elsewhere in the Upper Carson River Basin.

Aquatic and Marsh Communities. Before the wetlands of the Carson Valley were converted on a large scale to agricultural use, they were probably confined to the immediate margins of the free-flowing streams that crossed the basin floor. Low-lying areas may have developed at least seasonally into ponds or marshes, but internally draining basins, which might have produced more extensive wetlands, are not characteristic of the through-flowing Carson Valley (Miller, pers. comm.). Flood irrigation and impoundments associated with cultivation and grazing have created artificial marshy areas and ponds that supplement natural habitats.

Although minor patches of cattail (*Typha* sp.) and bulrush (*Scirpus* sp.) marsh do still occur throughout the basin, the only two remaining marshes of significance are the Walleys Hot Springs Marsh at the foot of the Sierras, and the more extensive wetlands of the Washoe Valley, north of and adjacent to Washoe Lake. Cattails, bulrush, and other emergent herbaceous plants grow in these larger marshes.

Irrigated agricultural soils in regions of low rainfall tend to accumulate salts over time. As a consequence, concentrations of salt in irrigation return waters are often high. Both major natural marshes receive runoff from irrigated lands to the south, and the effects of these waters on the vegetational components is not known. Long-term effects on the marshes, such as the appearance of more brackish water plants, might become apparent if further agricultural conversion and continuation of the present irrigation practices over time increases the salt imbalance in the runoff.

Agricultural Lands. While cattle grazing occurs on private and public lands throughout the Upper Carson River Basin, irrigated grassland and forage cropland is restricted to the alluvial lands of the Carson Valley. Range management practices and programs such as the BLM project for burn restoration and forage production in Jacks Valley contrast with the relative intensity of use of irrigated pasture and tilled lands, where alfalfa and hay have replaced many square miles of *Artemesia* - *Purshia* sagebrush steppe and willow-lined streams.

Succession on disturbed but uncultivated lands, such as roadsides and fallow fields, has been changed from the natural pattern. Invasion of naturalized annuals like *Sisymbrium* and annual brome grass (*Bromus* spp.) have interrupted and delayed the seral progression to a sagebrush steppe with a perennial grass component (Young *et al*., 1977).

Irrigated, grazed pastureland in the Upper Carson River Basin has much in common with the introduced, annual grasslands that blanket much of the valley and coastal lands on the western side of the Sierra divide. Annual associations are adapted to regions in which the growing season is confined largely to the late winter and spring, times of highest precipitation. Additional growth may be stimulated by artificial irrigation. During dry periods, the vegetational cover dies back, and the plants survive the seasonal drought as embryos contained within a resistant seed.

TABLE E-1

REPRESENTATIVE SPECIES OF VEGETATION[1]
UPPER CARSON RIVER BASIN

CONIFEROUS FOREST

Abies concolor
Amelanchier sp.
Arctostaphylos nevadensis
A. patula
Artemesia tridentata
Balsamorhiza sagittata
Calocedrus decurrens
Ceanothus cordulatus
C. velutinus
Cercocarpus ledifolius
Juniperus occidentalis
Pinus jeffreyi
P. lambertiana
P. ponderosa
Prunus emarginata
Purshia tridentata
Quercus vaccinifolia

SAGEBRUSH STEPPE

Artemesia tridentata
Astragalus spp.
Atriplex spp.
Balsamorhiza sagittata
Bromus rubens
Chrysothamnus nauseosus
Distichlis spicata var. *stricta*
Ephedra viridis
Eriogonum sp.
Erodium sp.
Happlopappus spp.
Mentzelia laeviculmis
Prunus andersonii
Salsola iberica

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[1] Based on field work conducted on 6/18/78 and 8/4/78, and on information from Taylor and Valum (1974); Young *et al* (1977); Vasck and Thorne (1977); and TRPA (1971i).

TABLE E-1 (Continued)

PINYON AND JUNIPER WOODLAND

Artemesia arbuscula
A. tridentata
Chrysothamnus nauseosus
Juniperus osteosperma
Pinus jeffreyi
P. monophylla
Purshia tridentata

STREAMSIDE VEGETATION

Alnus tenuifolia
Amelanchier sp.
Populus tremuloides
P. trichocarpa
Salix spp.
Scirpus sp.
Typha sp.

FRESHWATER MARSH AND LAKES

Eleocharis sp.
Salix sp.
Scirpus sp.
Typha sp.

AGRICULTURAL AREAS

Artemesia tridentata
Bromus spp.
Distichlis spicata var. *stricta*
Erodium sp.
Populus trichocarpa
Salsola iberica
Sisymbrium sp.

WILDLIFE

Wildlife Habitat

Conifer Forest. Generally remote, on the steep, east-facing slopes of the Carson Range, the Sierran conifer forest of the Upper Carson River Basin includes large areas of the Toiyabe National Forest and lies immediately across the ridgeline from other protected federal and state lands on the Tahoe side. The low levels of human intrusion into these forests is a primary attribute of that habitat. Conifer forest provides an abundant food resource in its cone crop. Seeds of Jeffrey pine (*Pinus jeffreyi*), the dominant forest species, are three times larger than seeds of the closely related ponderosa pine (*P. ponderosa*), a common associate of *P. jeffreyi* on slopes to the north and west (Arno, 1973). Shrubby understory plants, *Purshia tridentata* at low elevations, and manzanita (*Arctostaphylos* spp.) and serviceberry (*Amelanchier* spp.) higher up, provide browse, fruits, and seeds to many species of wildlife.

Conifer forest on the Carson Range is typical of that found on drier slopes throughout the central Sierra in wildlife habitat compositon and use. At the southern end of the Carson Valley study area near Markleeville, the mingling of the conifer forest with pinyon and juniper woodland of the Great Basin province, the Carson River headwater valleys and meadows, and the grazed agricultural lands increase the overall habitat diversity of the conifer forest. Many wildlife inhabitants of the conifer forest migrate in the fall to lower elevations to escape the rugged winter and return to their mountain habitats in the spring.

Sagebrush Steppe. Although the diversity of structural types and the extent of cover and nest sites is relatively minimal in the low-growing shrubland of the sagebrush steppe, this habitat is a valuable wildlife food resource. *Purshia*, a common component of sagebrush scrub, is a preferred browse plant for mule deer. The seed crop of annual plants and the vegetative portions of shrubs, perennial grasses, and forbs support resident and migratory populations of small mammals, birds, and an abundance of insects, such as the cicadas observed during a June 1978 field reconnaissance. These animal populations in turn are a source of food for raptorial birds, various reptiles, and larger mammals.

Pinyon and Juniper Woodland. Pinyon and juniper woodland in the study area supports a wildlife population that is more typical of the Great Basin than the Sierra. The open-growing, widely spaced pinyons provide moderate cover and nesting sites, but contribute a remarkable food supply. In a similar pinyon pine-Utah juniper woodland in Inyo County, birds exploit pinyon pine more extensively than any other vegetation in the habitat (Woodman, 1978). The pine nuts were an important dietary item of the Paiute Indian and today are harvested commercially for human consumption. Pinyon and juniper woodland also includes an open understory of important browse plants like *Purshia*.

Streamside Vegetation. In the relatively arid lands east of the Lake Tahoe Basin, water is an important limiting factor for wildlife. Most species of reptiles and amphibians (herptiles) require water for reproduction, and drinking water is necessary for most mammals and birds. Deciduous streamside thickets of willow and cottonwood offer nesting and denning sites, cover, succulent browse, and a corridor of cover along which many of the smaller wildlife species can travel. Accumulated leaf litter in the moist streamside environment provides breeding habitat for a variety of insects and other invertebrates, which in turn attract larger species of foraging and hunting wildlife.

Streamside habitat on the valley floor has been converted in recent times to agricultural uses and offers a more limited wildlife resource. The most valuable streamside habitat, associated meadowland, and aspen (*Populus tremuloides*) groves are found on the slopes of the Carson Range west of the basin floor and around the headwaters of the Carson River, north and west of Markleville. Although somewhat drier in overall aspect, these habitat types of the Upper Carson River Basin are very much the same as those described in the Lake Tahoe Basin.

Aquatic and Marsh Communities. The Carson Valley marshes are essential for waterfowl breeding and, in association with adjacent open water, attract migratory waterfowl and shorebirds. Some of these overwintering ducks and shorebirds, along with carp, other fish, and carrion are parts of a food web that includes a population of bald eagles, winter residents of the Carson Valley (Herron, pers. comm.). Development of the basin has reduced the marshland available to these and other species, making the remaining patches even more valuable to wildlife.

Impoundment of stock ponds and irrigation supply reservoirs has increased the amount of available open water in the area. Drainage and roadside ditches, when flooded, supplement these artificial improvements. Artificial open water areas, however, often lack the emergent shoreline and marsh vegetation that supplies more abundant food, valuable cover, and nesting sites.

Agricultural Lands. Cultivated lands of the central and southern valley floor are of more benefit to domestic livestock than to native wildlife. However, periodic flooding of irrigated lands creates temporary areas of shallow, open-standing water, attractive to many birds. The abundant seed produced by the grazed annual grasslands and alfalfa fields is exploited by seed-eating birds and small mammals that are also tolerant of nearby human activity. Utility poles and wires that criss-cross the agricultural lands are hunting posts for hawks, owls, and other raptorial birds, which prey on the insects and small seedeaters of the cultivated areas.

Range management practices that emphasize restoration and production of browse shrubs and nutritious grasses benefit domestic livestock and are compatible with native wildlife requirements as well.

Urban Areas. Town centers with extensive buildings, pavement, and landscape plantings are limited at present to Carson City at the north end of the basin and the south-central neighborhoods of Minden and Gardnerville. Incipient suburban sprawl is centered on areas south of Carson City and along U.S. Route 395. In these areas, introduced species like the house mouse, Norway rat, starling, house sparrow, and feral cats and dogs successfully compete with and often replace species of native wildlife that are intolerant of increased human activity and habitat alteration.

Wildlife Populations

Mammals. Large mammals still found in the Upper Carson River Basin are the mule deer, black bear, and mountain lion. Mountain lion (*Felis concolor*) live in the dry conifer forests and chaparral or sagebrush covered foothills of the Carson Range a have been reported in the Kingsbury Grade area within recent years (Herron, pe comm.). Black bear (*Euarctos americanus*) prefer more dense vegetation of the mou tainsides and are less often observed; the most recent reliable sightings in the Cars

Valley were nine years ago (Miller, pers. comm.). Mule deer (*Odocoileus hemionus hemionus*) are more numerous, and the major wintering ranges for the Interstate-Carson River and West Walker deer herds are in the Upper Carson River Basin.

Deer drop fawns and spend the summer in the southern parts of the Lake Tahoe Basin, then band into small herds (15 to 35 members) and leave the area in the fall and early winter, moving south and east along a migration corridor that includes Luther Pass, Armstrong Pass, and Waterhouse Pass. Summer residents of the eastern Lake Tahoe Basin drop over the crest of the Carson Range and descend into the foothill areas (Reed, pers. comm.). Sagebrush steppe of the foothills, from Jacks Valley south, and the understory of pinyon and juniper woodlands of the Indian Creek Reservoir region provide valuable, nutritious browse (e.g., Purshia) and are wintering grounds of primary importance for the Tahoe area deer herds (Smith, pers. comm.). With snowmelt in the spring, the deer leave the Upper Carson River Basin and scatter into high mountain meadows in Alpine County and the Lake Tahoe Basin, where fawning takes place.

Productive winter range is essential for the continued health of these deer herds. Adverse effects on traditional migration patterns and population numbers of the Verdi deer herd, some of which summer in the northern Lake Tahoe Basin, have been attributed to recent reduction of their winter range area by suburban sprawl from the Reno area, construction of Interstate Route 80, and other private developments (Wagner, pers. comm.).

Populations of feral burros and horses range throughout the Pine Nut Mountains (Christensen, pers. comm.).

Medium-sized mammal (furbearer) populations of the Upper Carson River Basin are similar to those of the Lake Tahoe Basin. Many medium-sized mammals, like the pine marten (*Martes americana*) and mountain beaver (*Aplodontia rufa*) inhabit the relatively moist and remote slopes of the Carson Range. Coyote (*Canis latrans*), bobcat (*Lynx rufus*), and grey fox (*Urocyon cinereoargenteus*) frequent drier sagebrush and chaparral areas. Beaver (*Castor canadensis*) introduced into the area overuse the limited aspen meadow habitats in the basin and cause watershed damage (Miller, pers. comm.).

Small mammals occupy most areas in the basin where there is adequate cover and food. Habitat requirements and sensitivities of the various species vary widely. Species typical of both the Sierran province and the Greater Basin area are found in the study area.

Agriculture, grazing, and range management may improve habitat for many small mammals, including deer mice (*Peromyscus* spp.) and pocket mice (*Peromyscus* spp.). The clearing of pinyon and juniper woodlands to stimulate deer browse production creates herbaceous areas and piles of timber slash that appear to increase local populations for these rodents (Turkowski and Reynolds, 1970; Baker and Frischknecht, 1973; Austin and Urness, 1976).

Birds. The diverse habitat resources of the Upper Carson River Basin support a varied resident avifauna and a number of species of seasonal and migratory birds. Seed and cone crops affect the distribution and abundance of seed-eating grassland birds and birds with specialized diets, such as the pinyon jay. Gamebird populations fluctuate in response to food supply, and an abundant pine nut crop has attracted a peak influx of band-tailed pigeons (*Columba fasciata*) to the area in recent months (Jeffress, pers. comm.). Insectivorous, omnivorous, and raptorial birds also respond to the distribution and abundance of their food sources: small mammals, insects, and herptiles of the open agricultural and sagebrush lands; insects and succulent buds, shoots, and other vegetation in moist streamside areas, drainage ditches, marshes, and mountain meadows; and waterfowl, shorebirds, fish, and carrion in impoundments, river channels, and marshlands.

Water-associated habitats in the Carson Valley are the most valuable for resident and migratory birds. Many species of smaller birds are attracted to these areas, especially during migration, and regionally significant populations of waterfowl and raptorial birds are dependent on the food, cover, and nesting sites found there.

Washoe Lake, at the northern end of the basin, is the largest breeding area in Nevada for Canadian geese (Branta canadensis). The Carson River, from Carson City south to Walleys Hot Springs, and Mud Lake, at the southern end of the basin, support wintering populations of ducks and geese. Smaller reservoirs are also used by waterfowl. Marshy areas are in general more valuable year-round habitat for watertowl and other birds than open-water areas with minimal vegetation, which are used primarily during spring and fall migration. In addition to Canadian geese, the most numerous breeding waterfowl are mallards (Anas platyrhynchos), gadwalls (A. strepera), and cinnamon teal (A. cyanoptera). Commonly wintering species include pintail (A.acuta), wigeon (A. americana), common merganser (Mergus merganser), mallard, and Canada goose (Saake, pers. comm.). Species abundance and diversity increase during fall and spring migration.

Waterfowl and shorebirds wintering in the area provide food for a wintering population of bald eagles (Haliaeetus leucocephalus), which also feed on fish and carrion. Riparian trees along the watercourses and reservoirs are used for roosting and hunting perches, and individual trees are often used year after year. Eagles move south into the Carson River area around November and remain until February or March, and occasionally as late as May (Herron, pers. comm.).

Deciduous aspens, alders, and cottonwoods, associated with streams, meadows, and other wet areas, are favored nesting habitat in Nevada for Cooper's hawks (Accipiter cooperii) and goshawks (A. gentilis). Breeding populations of these birds are reported to be in the wooded hills in the southeastern part of the basin and probably occur elsewhere in suitable habitat. Swainson's hawk (Buteo swainsoni) populations in Nevada are considered by the Nevada Department of Fish and Game to be of undetermined status, reflecting an apparent decline in numbers. Breeding pairs of this species are known to nest the cottonwoods along watercourses and agricultural lands in the southern end of the basin (Herron, pers. comm.).

TABLE E-2

REPRESENTATIVE SPECIES OF WILDLIFE[1] UPPER CARSON RIVER BASIN

MAMMALS

Common Name	Scientific Name
Vagrant shrew	*Sorex vagrans*
*Water shrew	*S. palustris*
Merriam shrew	*S. merriami*
Trowbridge shrew	*S. trowbridgii*
Broad-handed mole	*Scapanus latimanus*
*Little brown myotis	*Myotis lucifugus*
*California myotis	*M. californicus*
*Small-footed myotis	*M. leibii*
Pika	*Ochotona princeps*
White-tailed jackrabbit	*Lepus townsendii*
Nuttall's cottontail	*Sylvilagus nuttallii*
Desert cottontail	*S. audubonii*
*Snowshoe hare	*Lepus americanus*
Black-tailed jackrabbit	*L. californicus*
Mountain beaver	*Aplodontia rufa*
Least chipmunk	*Eutamias minimus*
Yellow pine chipmunk	*E. amoenus*
Long-eared chipmunk	*E. quadrimaculatus*
Lodgepole chipmunk	*E. speciosus*
Yellow-bellied marmot	*Marmota flaviventris*
White-tailed antelope squirrel	*Ammospermophilus leucurus*
Townsend's ground squirrel	*Spermophilus townsendii*
Belding's ground squirrel	*S. beldingi*
California ground squirrel	*S. beecheyi*
Golden-mantled ground squirrel	*S. lateralis*
Douglas' squirrel	*Tamiasciurus douglasii*
Northern flying squirrel	*Glaucomys sabrinus*
Southern pocket gopher	*Thomomys umbrinus*
Northern pocket gopher	*T. talpoides*
Long-tailed pocket mouse	*Perognathus formosus*
Dark kangaroo mouse	*Microdipodops megacephalus*
Great Basin kangaroo rat	*Dipodomys microps*
Ord's kangaroo rat	*D. ordii*
*Desert kangaroo rat	*D. deserti*
Merriam's kangaroo rat	*D. merriami*

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[1] Classification and nomenclature according to Jones *et al.* (1973).

* Expected in area, although specific data are lacking (Miller, pers. comm.; Burt and Grossenheider, 1964).

TABLE E-2 (Continued)

Common Name	Scientific Name
Beaver	*Castor canadensis*
Western harvest mouse	*Reithrodontomys megalotis*
Cactus mouse	*Peromyscus eremicus*
Deer mouse	*P. maniculatus*
Canyon mouse	*P. crinitus*
Brush mouse	*P. boylii*
Pinyon mouse	*P. truei*
Northern grasshopper mouse	*Onychomys leucogaster*
Desert woodrat	*Neotoma lepida*
Bush-tailed woodrat	*N. cinerea*
Montane vole	*Microtus montanus*
*Long-tailed vole	*M. longicaudus*
Muskrat	*Ondatra zibethica*
Black rat	*Rattus rattus*
House mouse	*Mus musculus*
Porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
*Red fox	*Vulpes vulpes*
Gray fox	*Urocyon cinereoargenteus*
*Black bear	*Ursus americanus*
Raccoon	*Procyon lotor*
Marten	*Martes americana*
Ermine	*Mustela erminea*
Long-tailed weasel	*M. frenata*
Badger	*Taxidea taxus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk	*Mephitis mephitis*
Mountain lion	*Felis concolor*
Bobcat	*Lynx rufus*
Wild burro	*Equus asinus*
Feral horse	*E. caballus*
Mule deer	*Odocoileus hemionus*

TABLE E-2 (Continued)

BIRDS[1]

Common Name	Scientific Name	Preferred Habitat[2]
Eared grebe	*Podiceps nigricollis*	F
Western grebe	*Aechmophorus occidentalis*	F
Pied-billed grebe	*Podilymbus podiceps*	F
Double-crested cormorant	*Phalacrocorax auritus*	F
Great blue heron	*Ardea herodias*	A,F
Great egret	*Casmerodius albus*	A,F
Snowy egret	*Egretta thula*	A,F
Black-crowned night heron	*Nycticorax nycticorax*	A,R,F
American bittern	*Botaurus lentiginosus*	F
White-faced ibis	*Plegadis chihi*	A,F
Whistling swan	*Olor columbianus*	A,F
Canada goose	*Branta canadensis*	A,F
Mallard	*Anas platyrhynchos*	A,F
Gadwall	*A. strepera*	A,F
Pintail	*A. acuta*	A,F
Green-winged teal	*A. crecca*	A,F
Cinnomon teal	*A. cyanoptera*	A,F
American wigeon	*A. americana*	A,F
Northern shoveler	*A. clypeata*	F
Redhead	*Aythya americana*	F
Ringed-neck duck	*A. collaris*	F
Canvasback	*A. valisneria*	F
Lesser scaup	*A. affinis*	F
Bufflehead	*Bucephala albeola*	F
Ruddy duck	*Oxyura jamaicensis*	F
Common merganser	*Mergus merganser*	F
Turkey vulture	*Cathartes aura*	A,C,P,S
Goshawk	*Accipiter gentilis*	C,P
Red-tailed hawk	*Buteo jamaicensis*	A,R,C,P,S
Swainson's hawk	*B. swainsoni*	A,R,S
Rough-legged hawk	*B. lagopus*	A,R,S

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[1] Includes common species, usually observed in a given area; and unique species, either abundant in one particular area but not elsewhere, or very rare or endangered.

Species list and habitat designation based on information from Panik (pers. comm.).

[2] A = Agricultural Areas
R = Streamside Vegetation
F = Freshwater Marsh and Lakes
C = Conifer Forest
S = Sagebrush Steppe
P = Pinyon and Juniper Woodland
U = Urban

TABLE E-2 (Continued)

Common Name	Scientific Name	Preferred Habitat
Golden eagle	*Aquila chrysaetos*	C,P,S
Bald eagle	*Haliaeetus leucocephalus*	R,F
Marsh hawk	*Circus cyaneus*	A,F
Prairie falcon	*Falco mexicanus*	S
Peregrine falcon	*F. peregrinus*	A,C,S
American kestrel	*F. sparverius*	A,R,C,P,S
Blue grouse	*Dendrogapus obscurus*	C
California quail	*Lophortyx californicus*	A,P,S,R
Mountain quail	*Oreortyx pictus*	C,P
Ring-necked pheasant	*Phasianus colchicus*	A,S
Chukar	*Alectoris chukar*	P,S
Virginia rail	*Rallus limicola*	F
Sora	*Porzana carolina*	F
American coot	*Fulica americana*	F
Killdeer	*Charadrius vociferus*	A,F
Common snipe	*Capella gallinago*	A,F
Greater yellowlegs	*Tringa melanoleuca*	F
Willet	*Catoptrophorus semipalmatus*	A,F
Least sandpiper	*Calidris minutilla*	F
Western sandpiper	*C. mauri*	F
American avocet	*Recurvirostra americana*	F
Black-necked stilt	*Himantopus mexicanus*	F
Wilson's phalarope	*Steganopus tricolor*	F
Northern phalarope	*Lobipes lobatus*	F
California gull	*Larus californicus*	A,F
Ring-billed gull	*L. delawarensis*	A,F
Forster's tern	*Sterna forsteri*	F
Rock dove	*Columba livia*	A,U
Mourning dove	*Zenaida macroura*	A,R,P,S
Barn owl	*Tyto alba*	A
Great horned owl	*Bubo virginianus*	R,C,P
Burrowing owl	*Athene cunicularia*	S
Long-eared owl	*Asio otus*	R,C,P
Short-eared owl	*A. flammeus*	A,R,P,S
Poor-will	*Phalaenoptilus nuttallii*	C,P
Common nighthawk	*Chordeiles minor*	A,C,P,S,U
White-throated swift	*Aeronautes saxatalis*	C,P
Rufous hummingbird	*Selasphorus rufus*	C,S
Calliope hummingbird	*Stellula calliope*	C,P,S
Belted kingfisher	*Megaceryle alcyon*	F

TABLE E-2 (Continued)

Common Name	Scientific Name	Preferred Habitat
Common flicker	*Colaptes auratus*	R,C,P
Lewis' woodpecker	*Melanerpes lewis*	R,C,S
Yellow-bellied sapsucker	*Sphyrapicus varius*	R,C,S
Hairy woodpecker	*Picoides villosus*	R,C,P
Western kingbird	*Tyrannus verticalis*	A,S
Say's phoebe	*Sayornis saya*	A,S
Empidonax flycatchers	*Empidonax* spp.	R,C,P
Western wood pewee	*Contopus sordidulus*	R,C,P
Horned lark	*Eremophila alpestris*	S
Violet-green swallow	*Tachycinetta thalassina*	A,F,C
Tree swallow	*Iridioprocne bicolor*	A,F,C,P
Rough-winged swallow	*Stelgiodopteryx ruficollis*	A,F,C
Barn swallow	*Hirundo rustica*	A,F
Cliff swallow	*Petrochelidon pyrrhonota*	A,C
Steller's jay	*Cyanocitta stelleri*	C,P
Scrub jay	*Aphelocoma coerulescens*	P,S
Black-bellied magpie	*Pica pica*	A,R,S
Common crow	*Corvus brachyrhynchos*	A,R
Pinyon jay	*Gymnorhinus cyanocephalus*	P,S
Clark's nutcracker	*Nucifraga columbiana*	C
Mountain chickadee	*Parus gambeli*	C,P
Plain titmouse	*P. inornatus*	P
Bushtit	*Psaltriparus minimus*	C,P,S,R
White-breasted nuthatch	*Sitta carolinensis*	C
Red-breasted nuthatch	*S. canadensis*	C,P
Pygmy nuthatch	*S. pygmaea*	C
Brown creeper	*Certhia familiaris*	C,P
Dipper	*Cinclus mexicanus*	R
House wren	*Troglodytes aedon*	A,R
Bewick's wren	*Thryomanes bewickii*	P,S,R
Long-billed marsh wren	*Cistothorus palustris*	F
Rock wren	*Salpinctes obsoletus*	C,P
Sage thrasher	*Oreoscoptes montanus*	S
American robin	*Turdus migratorius*	A,R,C,P,S
Hermit thrush	*Catharus guttatus*	C,P,R
Western bluebird	*Sialia mexicana*	C,P,S
Mountain bluebird	*S. currucoides*	C,P,S
Townsend's solitaire	*Myadestes townsendi*	C,P
Blue-gray gnatcatcher	*Polioptila caerulea*	P
Golden-crowned kinglet	*Regulus satrapa*	P
Ruby-crowned kinglet	*R. calendula*	C,R,P

TABLE E-2 (Continued)

Common Name	Scientific Name	Preferred Habitat
Water pipit	*Anthus spinoletta*	A,F,S
Cedar waxwing	*Bombycilla cedrorum*	A,R
Bohemian waxwing	*B. garrulus*	A,R
Loggerhead shrike	*Lanius ludovicianus*	A,C,P,S
Starling	*Sturnus vulgaris*	A,R,S,U
Solitary vireo	*Vireo solitarius*	C,P,R
Warbling vireo	*V. gilvus*	C,P,R
Yellow warbler	*Dendroica petechia*	R
Yellow-rumped warbler	*D. coronata*	A,C,P,R
Black-throated gray warbler	*D. nigrescens*	R
Macgillivray's warbler	*Oporornis tolmiei*	A,R
Common yellowthroat	*Geothlypis trichas*	R
Wilson's warbler	*Wilsonia pusilla*	A,R,C,P
House sparrow	*Passer domesticus*	A,R,S,U
Western meadowlark	*Sturnella neglecta*	A,S
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	A,F
Red-winged blackbird	*Agelaius phoeniceus*	A,F
Northern oriole	*Icterus galbula*	R
Brewer's blackbird	*Euphagus cyanocephalus*	A,R,F,S,U
Brown-headed cowbird	*Molothrus ater*	A,P
Western tanager	*Piranga ludoviciana*	C,P
Black-headed grosbeak	*Pheucticus melanocephalus*	C,P
Lazuli bunting	*Passerina amoena*	C,P,R
Evening grosbeak	*Hesperiphona vespertina*	A,R
Cassin's finch	*Carpodacus cassinii*	C,P
House finch	*C. mexicanus*	A,P,S,U
Pine siskin	*Carduelis pinus*	C
American goldfinch	*C. tristis*	A,R,C
Lesser goldfinch	*C. psaltria*	A,R,C
Red crossbill	*Loxia curvirostra*	C,P
Green-tailed towhee	*Pipilo chlorura*	C,S
Rufous-sided towhee	*P. erythrophthalmus*	C,P,S,R
Savannah sparrow	*Passerculus sandwichensis*	S
Lark sparrow	*Chondestes grammacus*	P,S
Black-throated sparrow	*Amphispiza bilineata*	C,P,S
Sage sparrow	*A. belli*	S
Dark-eyed junco	*Junco hyemalis*	C,P,S,R
Chipping sparrow	*Spizella passerina*	C,P,S,R
Brewer's sparrow	*S. breweri*	C,P,S
White-crowned sparrow	*Zonotrichia leucophrys*	A,R,S
Fox sparrow	*Passerella iliaca*	R
Song sparrow	*Melospiza melodia*	A,F,S

TABLE E-2 (Continued)

REPTILES AND AMPHIBIANS[1]

Common Name	Scientific Name
Great basin spadefoot	*Scaphiopus intermontanus*
Western toad	*Bufo boreas*
Pacific treefrog	*Hyla regilla*
Leopard frog	*Rana pipiens*
Bullfrog	*R. catesbeiana*
Northwestern pond turtle	*Clemmys marmorata marmorata*
Leopard lizard	*Crotaphytus wislezenii*
Collared lizard	*C. collaris*
Great basin fence lizard	*Sceloporus occidentalis biseriatus*
Yellow-backed spiny lizard	*S. magister uniformis*
Northern sagebrush lizard	*S. graciosus graciosus*
Side-blotched lizard	*Uta stansburiana*
Northern desert horned lizard	*Phrynosoma platyrhinos platyrhinos*
Western skink	*Eumeces skiltonianus*
Great basin whiptail	*Cnemidophorus tigris tigris*
Sierra alligator lizard	*Gerrhonotus coeruleus palmeri*
Rocky Mountain rubber boa	*Charina bottae utahensis*
Red racer	*Masticophis flagellum piceus*
Striped whipsnake	*M. taeniatus*
Racer	*Coluber constrictor*
Great basin gopher snake	*Pituophis melanoleucus deserticola*
Kingsnake	*Lampropeltis getulus californiae*
Western long-nosed snake	*Rhinocheilus lecontei lecontei*
Valley garter snake	*Thamnophis sirtalis fitchi*
Western terrestrial garter snake	*T. elegans*
Western aquatic garter snake	*T. couchi couchi*
Western ground snake	*Sonora semiannulata*
Desert night snake	*Hypsiglena torquata deserticola*
Great basin rattlesnake	*Crotalus viridis lutosus*

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[1] Based on information from Stebbins (1966) and Miller (pers. comm.).

FISH

Native fish of the Carson River and tributary streams are the mountain whitefish (*Prosopium williamsoni*), Lahontan sucker (*Catostomus platyrhynchus*), and Tahoe sucker (*C. tahoensis*). Although periodic diversions for agriculture adversely affect the continuity of summer stream flows, irrigation ditches and laterals also supply nursery habitat. This habitat is particularly important for the whitefish, suckers, and native forage fish, like the redside shiner (*Richarsonius egregius*) and speckled dace (*Rhinichthys osculus*).

The Nevada Department of Fish and Game stocks the East and West Fork Carson River early in the year to take advantage of high spring streamflows and to maximize angler access before water levels drop in late summer and early fall. The Carson River is heavily planted predominantly with brown trout in the West Fork and rainbow trout (*Salmo gairdneri*) in the East Fork. Recent allocations were for 5,750 pounds of fish for the East Fork and 600 pounds for the West Fork. Whirling disease, caused by an introduced parasite (*Myxosoma cerebralis*), typically affects some populations of fish reared in Nevada for stocking. Introduction of whirling disease into California is controlled by only stocking areas downstream from existing barriers to fish movement. The West Fork Carson River is stocked annually by the California Department of Fish and Game and the Alpine County Fish and Game Commission with brown, brook, rainbow, and cutthroat trout. Whitefish, speckled dace, and suckers also inhabit the streams.

Indian Creek Reservoir contains planted trout, tui chub (*Gila biocolor*), and speckled dace. Eutrophication of the reservoir is severe at times and fish kills from high concentrations of ammonia occur periodically in early summer (Wickwire, pers. comm.). More detailed studies of eutrophication in the reservoir have been conducted for the Lake Tahoe Area Council, and water quality there is being monitored by the California Department of Fish and Game. STPUD has recently instituted additional limnological investigations at Indian Creek Reservoir (Davis, pers. comm.).

Brown trout (*Salmo trutta*) have been introduced. They have become adapted to the lower reaches of the streams and reproduce naturally in the area. Bullheads (*Ictalurus* sp.) and largemouth bass (*Micropterus salmoides*) have also been introduced, and populations have become established at Walley's Hot Springs.

Except, where otherwise noted, this section is based on information from Frantz (pers. comm.).

2. WATER RESOURCES

TABLE E-3

GROUNDWATER IN STORAGE
LAKE TAHOE BASIN AND UPPER CARSON RIVER BASIN

Valley Groundwater Reservoir	Storage interval (feet)	Groundwater storage (1,000 acre-feet)
Washoe Valley	upper 100	270
Eagle Valley	upper 100	200
Carson Valley	upper 100	810
South Tahoe Valley	upper 100	84
North Tahoe Valley	Undefined	

Source: U.S. Department of Agriculture Nevada River Basin Study Staff, Water and Related Land Resources: Central Lahontan Basin, 1975.

TABLE E-4

SOURCES OF POLLUTION - CARSON RIVER BASIN

By utilizing limited existing information and by making broad generalizations as to agricultural contributions (based on extrapolations from test plots), the following summary of average daily discharges was developed:

	1,000 lbs			
	TDS 1/	BOD 2/	Total N 3/	Total P 4/
Urban Sewage	10.8	0.79	0.87	0.60
Surface Irrigation Returns	127.1	6.03	0.91	0.44
Groundwater Return to River in Irrigated Areas	49.9	0.99	0.10	0.04
Natural Sources	54	1.03	0.29	0.04
Truckee Canal	189	2.50	1.64	0.38
Material crossing Stateline to Nevada	163	3.47	0.78	0.10

However, the two agricultural contributions represent both pollutants initially diverted from the River and pollutants picked up by agricultural practices. Actual agricultural contributions from both sources combined cannot be mathematically separated and must be accounted for on a reach-by reach basis.

	1,000 lbs			
	TDS 1/	BOD 2/	Total N 3/	Total P 4/
Agricultural contribution	33	3.93	.20 .20	.30

1/ Total Dissolved Solids or Salts

2/ Biochemical Oxygen Demand or Oxygen consuming Ability

3/ Total Nitrogen - Nitrogen is a key nutrient

4/ Total Phosphorus - Phosphorus is a key nutrient

3. VISUAL RESOURCES

EXISTING CONDITIONS

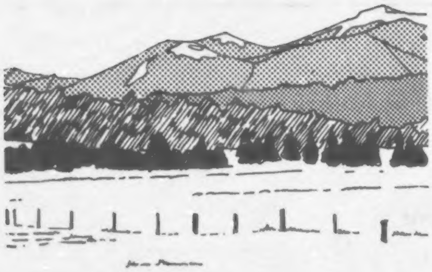
For this study, visual conditions along roadway units of the Upper Carson River Basin were analyzed. Conditions of these units are described below.

The major roadways were divided into units by location (stretches of road frequently travelled as a single unit) and landscape characteristics. Roadway units were then divided into segments that offer varied landscape experiences to the viewer. The roadway units and visual characteristics are mapped in Figure E-1.

The visual quality of each unit was assigned a rating (low, moderate, high, or exceptional) based on an evaluation of visual conditions. The description of these conditions and the ratings assigned for each unit are given below.

Roadway Unit I

Description. Highway 89 is the western entrance of the Upper Carson River Basin; it descends dramatically from the ridgeline through three distinct visual segments of the northern end of the Hope Valley.



Segment A: Entrance is characterized by enclosure of trees and roadside vegetation with glimpsed views south of Hope Valley.

Segment B: Road opens to small bowl with meadow foreground and mountain background, and short-range views from all sides.

Segment C: Road descends to center of northern end of Hope Valley with panoramic views out to snow-capped mountains in distant background, forested mountains in middleground, and level meadows crossed by streams and riparian vegetation in foreground.

Components.

1. Man-made features

   - fencing for pasture along roadside, does not block views.

2. Landscape features

- topography: varied, unaltered by development, except for roadbed; no visible cuts and fills along roadway.
- vegetation: roadside vegetation not disturbed; compositions and color varied and interesting.
- views: frequent views of varying kinds (short and long-range and glimpsed).
- other features: streams and West Fork Carson River.

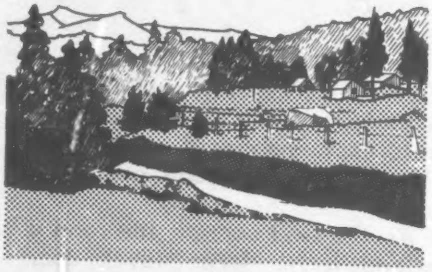
3. Roadway

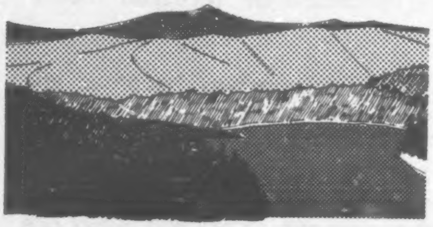
- 2-lane road in good condition.
- little traffic, no distracting roadsigns.

Rating: High

Roadway Unit 2

Description. Highway 88 travels south through the northern end of Hope Valley to Carson Pass exit from the basin. Three landscape segments are included in this unit.





Segment A. The first part of the road travels through Hope Valley, a large floor enclosed by forested mountains on all sides and snow-capped peaks to the south. A few cattle ranches and farm buildings are seen in this unit.

Segment B: As the valley narrows, and the road climbs, the views are enclosed, but the foreground landscape becomes more varied, with streams near the roadside, and small wood cabins in the meadows.

Segment C: The last part of the road climbs steeply, and steep rocky slopes and vegetation enclose side and forward views. There are spectacular views backward of the basin and of Red Lake.

Components.

1. Man-made features

- fencing for pasture along roadside.

- infrequent wood cabins and farm dwellings.

2. Landscape features

   - topography: varied, unaltered by development except for roadbed; minor areas of cut-and-fill visible, except segment C where most of large cut banks have been revegetated, or are rocky cliffs.
   - vegetation: roadside vegetation undisturbed, or revegetated; of varied types, compositons, and colors.
   - views: varied and frequent views for segments A and B; spectacular views in segment C of Hope Valley and Red Lake.
   - other features: streams and rock formations in meadows.

3. Roadway

   - segments A and B: 2-lane road in good condition; no distractions.
   - segment C: high-speed 4-lane road in good condition; high speeds detract from visual experience.

Rating: High

Roadway Unit 3

Description. Blue Lakes Road is a two-lane road that travels south through a series of three valleys, and ends in a dirt road at the study area boundary. The road crosses the West Fork Carson River, and aside from a single national forest campground and grazing, has no development visible from the road. This road is of unusually high scenic quality.

Segment A: The first part of the road is characterized by a large level open meadow, with extremely long panoramic views and enclosed by forested mountains.

Segment B: The roadway becomes enclosed by roadside forest vegetation as it climbs Faith Valley. Midway, the road crosses the West Fork Carson River, and the river is visible along the road for the rest of the segment. Forward views are of rocky mountain formations in the foreground, alternating with forest groves.

Segment C: The most southern part of this segment opens onto a high meadow, Faith Valley, enclosed by forests in the middleground and snow-capped peaks in the background. Views from the road are enclosed again for a short distance by a forest passage, and open again onto Charity Valley, a smaller high meadow with views to the northeast.

Components.

1. Man-made features

- the Hope Valley Campground is visible to the west in Segment A; in segment C a cattle pen and farm structure are visible near the end of the paved road (design of the latter enhances rather than detracts from the landscape).
- fencing for pasture along roadside.

2. Landscape features

- topography: varied, unaltered by development except for road bed.
- vegetation: roadside vegetation undisturbed; varied types, compositions, and colors.
- views: views frequent and highly varied; frequent alternation between closures and openings.
- other features: rock-strewn pastures, the river, and variety of rock formations.

3. Roadway

- 2-lane road in good condition; no distractions.

Rating: Exceptional

Roadway Unit 4

Description. Highway 89 leaves Hope Valley area and travels west/east towards Carson Valley. This roadway unit is characterized by enclosure of varying sizes, and the presence of the West Fork Carson River, which is intermittently visible throughout.

Segment A: The road begins in Hope Valley with short-range panoranic views narrowing as the road enters the Carson River Canyon. A trailer park is located at the intersection of Highway 88 and 89. A small resort (Sorensen's) is located midway through the unit on the south side of the road.

Segment B: Rock walls narrowly enclose the road and cut off views in all directions as the road passess through Carson River Canyon. Glimpses can be seen of the Pine Nut Mountains in the distance midway through this section. At the east end, views of the Pine Nut Mountains are constant, and the canyon walls give way to forest vegetation that encloses both sides of the road.

Components

1. Man-made features

- trailer park at beginning of unit is distracting with highly reflective surfaces.
- Sorensen's resort: a minor interruption to otherwise natural landscape; building materials and architecture harmonious with landscape.
- National Forest campgrounds sited to the south do not impose on landscape character.

2. Landscape features

- topography: varied; some large cuts-and-fills visible, though most revegetated and slopes rocklined.
- vegetation: varied; some disturbance to vegetation in a few areas.
- views: limited by narrow enclosures in some areas, varied view types, such as short panoramic, glimpsed views and long-range; also intermittent views of river near road.
- other features: river adds constant interest.

3. Roadway

- 2-lane road in good condition; some distraction caused by entrances and exits from campgrounds and Sorensen's resort.

Rating: High

Roadway Unit 5

Description. Highway 89/Highway 4 travels south from Woodfords to Markleeville. Woodfords forms a visual node between three roadway units, and is a focal point for the beginning of this unit. The roadway sequence has a symmetrical visual structure. Markleeville and Woodfords provide visual nodes as destination points. Each end of the road is enclosed by topography and forest vegetation. The middle part of the road is a series of clearings of varying sizes.

Segment A: The first part of the roadway is well-enclosed, with foreground views limited by pine vegetation and the winding road. Some isolated houses and trailers are located along this stretch, but are generally well-camouflaged by trees.

Segment B: The middle part of the road is a series of clearings separated by brief closures of vegetation. Views here are fairly short range, bounded by hills on all sides.

Segment C; The last stretch of road is again enclosed by trees and topography. Just before Markleeville, the road opens again, and a trailer park can be seen on the east side. Markleeville, a small town in a bowl encircled by mountains, terminates the view.

Components.

1. Man-made features

- trailer park at end of unit near Markleeville is distracting.
- houses at beginning of unit are only a minor disturbance to otherwise natural landscape.
- communities of Woodfords and Markleeville function as well-contained unified focal points for roads and provide visual interest rather than distraction.
- other man-made features limited to infrequent traffic signs and pasture fencing.

2. Landscape features

- topgrcphy: varied; winding road and changes in elevation between units lend interest; steep cuts and fills on segment C of roadway, many of them not revegetated.
- vegetation: varied; some disturbance of roadside vegetation in Segment C; forest enclosures highly effective in heightening contrasts.
- views: of moderate interest due to alternation between enclosures and openings; no long-range or panoramic views exist.

- other features: none.

3. Roadway

   - 2-lane road in good condition.

   Rating: High

Roadway Unit 6

Description. This roadway unit on Highway 88 descends from Woodfords into the Carson Valley in a southeast/northwest direction. The first panoramic views of the Carson Valley area are available here, and characterize the unit. The Carson Valley is partially revealed at this point. The Pine Nut Mountains are visible in the distance. In the foreground, Diamond Valley and Wade Valley are visible. Although the West Fork Carson River and Snowshoe Thompson ditch run through Diamond Valley, only riparian vegetation can be seen from the roadway. Vegetation types change abruptly at this point from forest to sage and chaparral brushlands, and pastures dotted with riparian growth. This unit has only one segment.

Segment A: The roadway's most distinquishing features are panoramic views, and new vegetation types. The Pine Nut Mountains are not as distant as they appear, but the impression is of extremely long range views. The road becomes relatively straight at this point, and descends rapidly.

Components.

1. Manmade features

   - several houses on steep slopes unscreened by vegetation.
   - roadsigns.
   - fencing for pasture.
   - telephone poles along roadside.

2. Landscape features

   - topography: sharp descent, abrupt changes from previous units, and views of mountain ranges give impression of greater topograhical variation then actually exists within the unit; cuts and fills highly visible.
   - vegetation: more limited than in previous units; low; does not provide contrasts and variety of compositional forms.

- views: little variety; panoramic views exceptional.
- other features: none

3. Roadway
   - 2-lane roadway in good condition; roadside signs infrequent but distracting; high-speed roadway detracts somewhat from opportunity for observation.

Rating: Moderate

Roadway Unit 7

Description. Highway 88 enters the valley floor of Carson Valley and extends south to north. The valley is a huge flat floor surrounded by mountains on all sides. The dramatic Carson range on the west side looms in the near background, and the lower Pine Nut Mountains on the east form a more distant background. The valley closes at the north end with low hills extending from the Carson Range. The valley floor is in pasture, green in summer, with farm settlements dotted infrequently across the landscape. These settlements are usually marked by clumps of trees. Canals and streams cross the valley floor. Snow-capped peaks of the Carson Range are visible. The road is straight and flat.

Segment A: The most southern part of the road is more enclosed than the rest. The steep slopes of the Carson Range on the west, and the lower hills on the Pine Nut Mountains on the east are near the road here. The foreground is in pasture, and a tree-lined stream crosses the road.

Segment B: The mountains recede on either side to form a very large open bowl with distant views. The character of this road segment is homogeneous and unvaried, although the surrounding landscape provides a high degree of interst.

Components.

1. Man-made features
   - isolated farm settlements, surrounded by trees scattered throughout the valley.
   - irrigation canals.
   - fencing for pasture along road.

2. Landscape features

- topography: unvaried in the valley floor; mountain ranges on all sides provide views of highly variable topography.
- vegetation: flat agricultural fields provide dominant landscape element; tree clumps around settlements and trees along streams and canals provide contrast.
- views: constant long-range panoramic views.
- other features: none

3. Roadway

- 2-land road in good condition.

Rating: Moderate

Roadway Unit 8

Description. U.S. 395 travels northwest to southwest from the twin towns of Minden-Gardnerville to the base of the Pine Nut Mountains. Minden-Gardnerville are small communities that together form a single visual urbanized area. Both are fairly compact, with the exception of a single residential development visible from the roadway south of Gardnerville.

The rest of the road is an agricultural landscape like that in Roadway Unit 7: it ends abruptly at the foot of the Pine Nut Mountains.

Segment A: The towns of Minden and Gardnerville cluster along U.S. 395, and are the largest urbanized area in the Carson Valley. The road through the towns is tree-lined. Buildings and trees block views of the surrounding valley floor; mountains are visible in northwest and southeast views from the roadway. Most of the buildings are low rise (one and two stories) and of a consistent character and architecture, especially in Gardnerville. Exceptions are the new shopping center between the two towns, and the new residential development southeast of Gardnerville.

Segment B: This segment is similar in type to that in segment B of Roadway Unit 7, with agricultural fields in the foreground and the Pine Nut Mountains as a backdrop.

Components.

1. Man-made features

   - buildings in Minden-Gardnerville provide visual contrast to rural landscape; many are visually interesting because of their age and architecure.
   - signs along the commercial strip in Minden and signs for new shopping center between Minden and Gardnerville are distracting.
   - isolated farm settlements within viewing distance of segment B.
   - irrigation canals.
   - fencing for pasture along roadside.

2. Landscape features

   - topography: flat and unvaried; views of mountains in background provide topographical contrast.
   - vegetation: same as Roadway Unit 7; in addition, tree-lined streets in towns provide urban landscape.
   - views: same as Roadway Unit 7, except from within two towns where views are blocked by buildings and vegetation.
   - other features: streams.

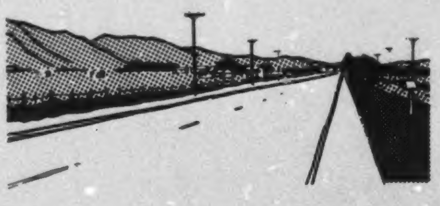
3. Roadway

   - 2-lane road in good condition.

Rating: Low

Roadway Unit 9

Description. Highway 88 continues from Minden and Gardnerville to the end of the Carson Valley. Visual conditions here are similar to those in Roadway Unit 7. The road is straight and flat. Mountain ranges enclose the large valley floor, which is studded with tree groups and farm settlements, and crossed by streams and canals. This unit has only one segment.



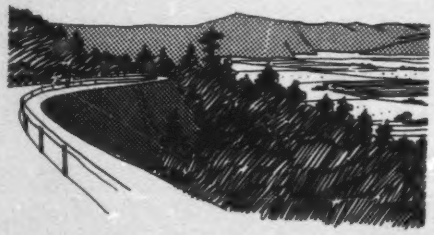
Segment A: This segment is identical to segment B of Roadway Unit 7, except that Carson City forms a northern terminal focus of views. Variety is lacking.

Components. Components of this unit are similar to those in Roadway Unit 7, Segment B.

Rating: Low

Roadway Unit 10

Description. Kingsbury Grade road from beginning at the western edge of the basin descends into Carson Valley to meet Highway 88. The first part of the road descends steeply, and views are enclosed by mountain slopes on both sides. Brief long-range views open at fixed points. At the north-south turning of the road expansive views of the Carson Valley open, and the entire valley floor is visible. These long-range vistas continue intermittently until the road descends to the valley floor, at which point the road straightens, and views of agricultural fields and low mountain backdrops, similar to those of Roadway Units 7 and 9, resume.



Segment A: The road is curving and enclosed on both sides by steep mountain walls and forest vegetation. There are brief views of the Carson Valley offered to the south.

Segment B: At the major turning point, spectacular views of the Carson Valley to the east and south open. Minden-Gardnerville, Genoa, and scattered residential development are clearly visible from this height. The road is still enclosed on the west by steep slopes. Vegetation changes from forest to sage and chaparral brushland. As the road descends, views become less frequent, and blocked by hills.

Segment C: The road becomes flat and straight, passing through pastures, with views of the Pine Nut Mountains. The foreground views are not extensive, due to the low elevation of the road.

Components

1. Manmade features

- no houses visible from the roadway in segment A; development patterns in Carson Valley seen in views from segment B.

2. Landscape features

- topography: land form is highly variable in segments A and B; no significant topographical variation in segment C, roadcuts along entire length of roadway infringe on views.
- vegetation: segment C heavily forested with alpine vegetation; major change in vegetation occurs on lower slopes to drier vegetation types, with brush-covered slopes and interspersed tree groups; segment C vegetation typical of rest of Carson Valley, with pastures and tree clumps.
- views: vistas of exceptionally high quality in segment B, but limited in segments A and C.
- other features: none

3. Roadway

- two-lane road in good condition; sharp curves and high speeds limit opportunity for observation.

Rating: High

Roadway Unit 11

Description. Highway 50 unit begins at western edge of basin (Spooner Summit) and descends to Highway 88 in Carson Valley south of Carson City. The road is characterized by narrow passages formed by steep mountain walls and heavy vegetation alternating with brief openings with long-range views.

Segment A: This long narrow passage permits no views out to either side. Heavy forest vegetation and steep mountain walls enclose the roadway.

Segment B: The mountain walls on the south recede to the middleground, and there are long-range views of Carson Valley to the south at a division between the mountains. There are short-range views to the south in the area of Toiyabe State Park. Vegetation here changes from alpine to lower, brushland scrub vegetation.

Segment C: The last segment of this unit is enclosed on all sides by the lower slopes of the Carson Range. Terminal views of the Carson Valley and Pine Nut Mountains are offered at the intersection of Highways 88 and 50.

Components

1. Man-made features

   - no houses or structures are visible adjacent to the roadway; the New Empire area of the valley is visible at the intersection with Highway 88; development in the Carson Valley can be seen in the long range views from segment B.

2. Landscape features

   - topography: extremely varied in all units; highway roadcuts large and detract from scenic quality.

   - vegetation: two types of vegetation--alpine in segment A and dry sage and chaparral brushland in segments B and C.

   - views: no views to the north; limited but spectacular views of the Carson Valley open at a single point; short-range views of adjacent slopes, and terminal views of the valley.

   - other features: none

3. Roadway

   - high-speed four-lane road; viability is reduced by need for attentive driving.

Rating: Low

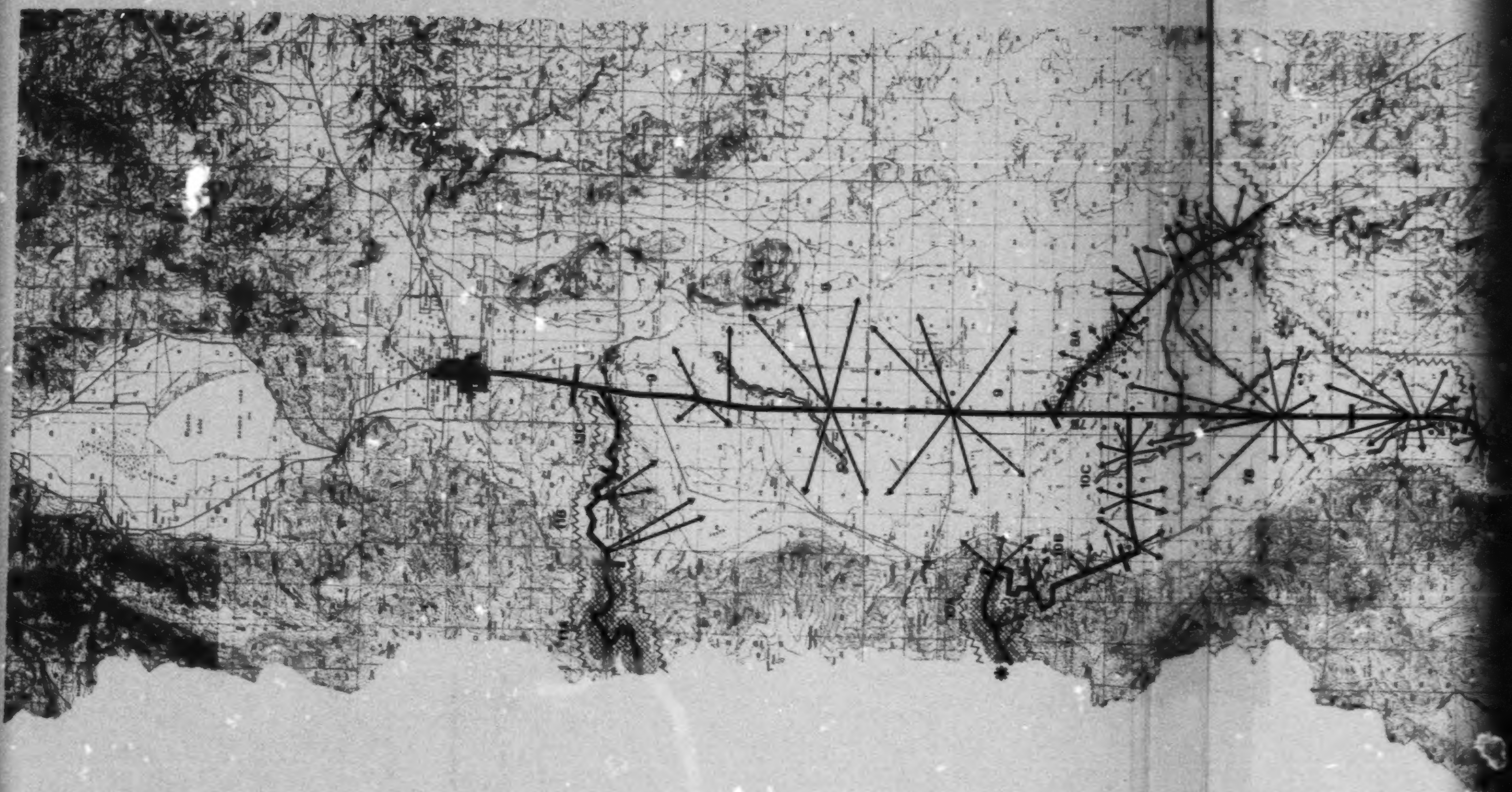
The visual quality of all roadway units in the Upper Carson River Basin is unusually high, as described above and summarized in Table E-5. Even those units given low or moderate ratings are of high quality when compared to areas outside the basin. There are several roadway units, however, especially vulnerable to visual deterioration because they are of exceptionally high visual quality and presently undeveloped or are highly visible from other areas. These units are described below in order of their vulnerability:

- roadway unit 3: Presently undeveloped and of exceptionally high visual quality. Any development would intrude on the character of the area.

- roadway unit 2: High visual quality, variety of visual sequences, and natural character of this unit warrant protection from substantial change.

- roadway unit 5: This unit has an unusually high degree of definition of visual form in the natural landscape. Further development should be limited and subject to appropriate design controls.

- roadway unit 10: The Kingsbury Grade is highly visible from the floor of Carson Valley. Large road cuts are visible for a distance of many miles. Any further change or development of this unit would degrade not only the quality of the roadway unit itself, but the quality of visual conditions within the valley.


11C
11B
11A
9
9
8A
10C
10B

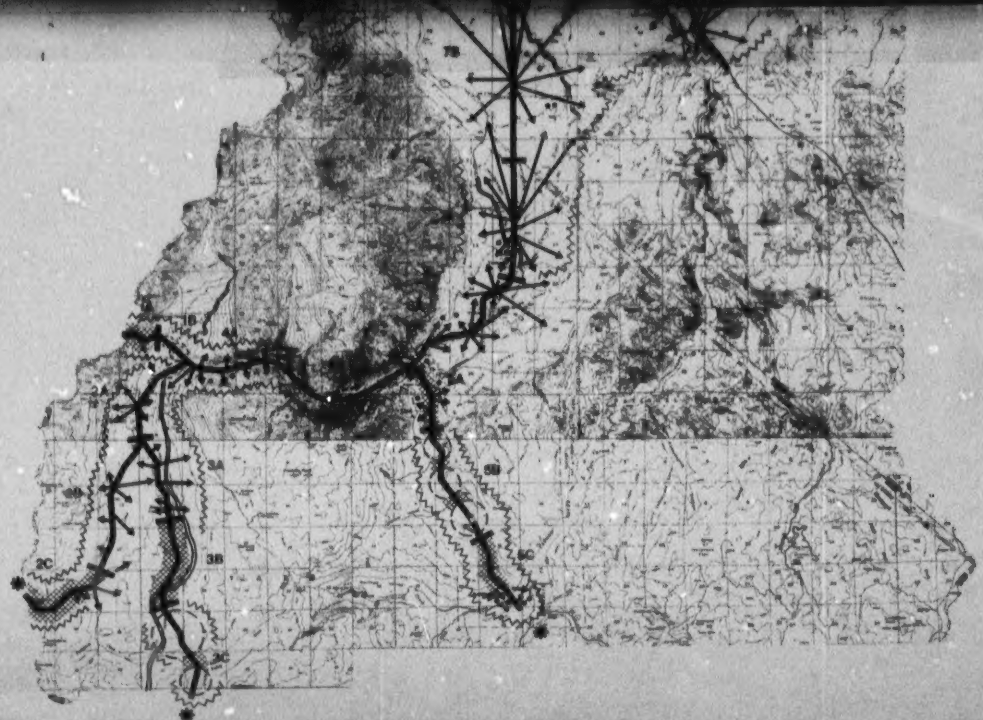


Figure E-1 VISUAL CONDITIONS UPPER CARSON RIVER BASIN

7A | 7B | 7C	NUMBERS REFER TO ROADWAY UNITS
|— 7B —|	LETTERS REFER TO ROADWAY SEGMENTS
◌	CLEARING WITH PANORAMIC VIEW
▨	VIEW ENCLOSED WITH VEGETATION
〰	VIEW ENCLOSED BY TOPOGRAPHY
≈	WATER FEATURE
*	UNITS OF HIGH VULNERABILTY
∴	MANMADE FEATURES
	VIEWS:
	→ SHORT RANGE ⟶ LONG RANGE - - → INTERMITTENT

Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency
Sedway/Cooke

0 1 2 4 miles
north

3

TABLE E-5

VISUAL CHARACTERISTICS OF ROADWAY UNITS RATING SUMMARY

Unit No.	Unit Description	Rating
1	Highway 89, western entrance to the Upper Carson River Basin	High
2	Highway 89, between northern end of Hope Valley and Carson Pass exit from the basin	High
3	Blue Lakes Road	Exceptional
4	Highway 89, between Hope Valley and Carson Valley	High
5	Highway 89/Highway 4, between Woodfords and Markleeville	High
6	Highway 88, between Woodfords and Carson Valley	Moderate
7	Highway 88, north-south through Carson Valley floor	Moderate
8	Highway 395, between Minden-Gardnerville area and base of Pine Nut Mountains	Low
9	Highway 88, between Minden-Gardnerville area and the end of the Carson Valley	Low
10	Kingsbury Grade, between western edge of basin and Highway 88	High
11	Highway 50, between western edge of basin (Spooner Summit) and Carson Valley south of Carson City	Low

MITIGATION MEASURES

1. Adopt areawide design plan to guide location and type of development.

   Description. A design plan for the Upper Carson River Valley and Alpine County would provide guidelines for development and performance standards to prevent degradation of visual and environmental quality. Guidelines would include measures for preserving agricultural lands, protecting biological resources and floodplain areas, and guiding location and type of development.

   Effectiveness. Could be highly effective if implemented by ordinance and design review.

   Responsibility. Douglas County, Alpine County.

   Cost. Administrative.

   Timing. Should be formulated and adopted within five years to be effective.

2. Update zoning ordinance to prevent scattered, low-density development.

   Description. Scattered, low-density development in Douglas County will significantly degrade visual resources, as the valley floor and mountain slopes are visible from all roadways. Concentration of well-designed residential development in suitable areas would mitigate ill effects of high levels of development.

   Effectiveness. Most effective if coordinated with measure 1 above; otherwise dependent upon powers and enforcement of ordinance.

   Responsibility. Douglas County.

   Cost. Administrative.

   Timing. Coordinate with measure 1 above.

3. Adopt ordinance to prevent development on steep slopes visible from roadways.

   Description. In Alpine County and Douglas County, protection of steep slopes from roads and residential development would prevent new visual problems such as erosion and loss of vegetation and would protect existing visual resources.

   Effectiveness. Most effective if coordinated with measure 1 above; otherwise dependent upon powers and enforcement of ordinance.

   Responsibility. Alpine County, Douglas County.

   Cost. Administrative.

   Timing. Coordinate with measure 1 above.

4. Develop transportation plan to prevent increases in air pollution and reduction in visibility.

5. Designate scenic roadways to prevent alteration or degradation of most valuable roadway units.

Description. Alpine County contains three of the four roadway units (units 2, 3, and 5) described as most valuable and most subject to degradation. A fourth unit is the Kingsbury Grade road in Douglas County. Designation of all four units as scenic highway would protect them from alteration, especially if provision were made to restrict development within viewing distance of the roadway.

Effectiveness. Could be highly effective if action were taken immediately. Roadway unit 5 (Highway 89 from Woodfords to Markleeville) is scheduled for rebuilding by Caltrans in 1979, with significant alterations to the existing road and increases in design speed.

Responsibility. Alpine County, Caltrans, Douglas County, and Nevada Department of Highways.

Cost. Undetermined; funds ($2.8 million) now scheduled for rebuilding of unit 5 might be diverted to scenic highways program.

Timing. See "Effectiveness" above.

6. Require landscaping and erosion control on disturbed areas.

Description. Grading and road-cuts disturb vegetation, cause erosion, and create unsightly scars. All projects, public and private, should incorporate landscaping and erosion control.

Effectiveness. Could be highly effective in areas of unconsolidated soils, except where dramatic alteration of native vegetation is involved. Landscaping would not be feasible in most granitic soils (e.g., road unit 10-B on Kingsbury Grade) where scars will be healed only after decades of weathering.

Responsibility. Public projects: Caltrans and Nevada Department of Highways. Private Projects: Alpine County and Douglas County.

Cost. Undetermined.

Timing. Should be programmed into project construction.

F. SOCIAL ENVIRONMENT IN UPPER CARSON RIVER HYDROGRAPHIC BASIN

1. LAND USE

HISTORIC LAND USE

The earliest non-Indian explorer was Jedidiah Smith who passed through the area in the late 1820s. Captain Joseph R. Walker, the Battleson-Bidwell party, the first Fremont expedition, and other groups immigrating to California followed. Kit Carson crossed the Sierra many times in the 1840s, and it is after him that Carson Valley, Carson River, and Carson Pass are named.

The study area was bypassed by permanent settlers heading for the California gold fields until 1851, when a group of immigrants from Salt Lake City settled at Genoa, then called Mormon Station. Later settlements concentrated on the west side of the valley, which formed the route from Carson City over Carson Pass or Luther and Echo passes into the California Central Valley. The Pony Express followed this latter route during its brief history from April 1860 to October 1861. Gardnerville was founded in 1881 and Minden in 1906, a peculiar division that was confirmed by the extension for political reasons of the Virginia-Truckee Railroad to Minden rather than to Gardnerville. The route of the railroad, right down the center of the valley, reestablished the main north-south route from the west side of the valley to what is now U.S. Highway 395. Genoa was left off the main route and stagnated.

The development in Carson Valley changed very little from the turn of the century to after World War II. Only recently has development occurred in clusters south of Gardnerville (the Ranchos area), north of Minden in the Johnson Lane area, in Jacks Valley, along the eastern slopes of the Carson Range, and in scattered pockets throughout the valley. The predominant land use, however, is still agriculture.

The settlement of Alpine County followed a similar pattern. The attractions of Alpine County were mining and logging, although its position on an important trans-Sierra route explain the presence of Woodfords and other settlements along the West Fork of the Carson River. Markleeville and Woodfords were and are the only significant settlements in the study area.

PRESENT LAND USE

Tables F-1 and F-2 show dwelling units by traffic zone in the Carson Valley, Douglas County, and Alpine County. Table F-3 shows landownership in Douglas County.

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TABLE F-1

DWELLING UNITS BY TRAFFIC ZONE
CARSON VALLEY, DOUGLAS COUNTY

Traffic Zone	Dwelling Units
52	62
53	211
54	828
55	769
56	0
57	0
58	127
59	6
60	123
61	349
62	16
63	134
64	267
65	29
66	221
67	11
80	26
Subtotal	3,179
Mobile Homes Outside Parks	441
Mobile Homes In Parks	162
Subtotal	603
Total	3,782

Source: Douglas County Fire Department, Survey of Growth in East Fork District, May 1978, pp. 7-9. Dwelling units allocated to zones on basis of percentage estimates by Sedway/Cooke.

TABLE F-2

DWELLING UNITS BY TRAFFIC ZONE: ALPINE COUNTY PORTION OF UPPER CARSON RIVER BASIN

Traffic Zone	Dwelling Units	Subdivided Vacant Parcels
028101	96	71
028102	3	0
028103	88	0
TOTAL	187	71

Source: Alpine County, General Plan (revised), 1974, count by Sedway/Cooke

TABLE F-3

LANDOWNERSHIP IN DOUGLAS COUNTY

Owner	Acres	Percent
BLM	194,947	41
Forest Service	42,991	9
Other Federal	29,989	4
Indian	59,072	12
Other Private	161,535	34
All Other	1,106	*
Total	489,640	100

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*less than 1 percent

Source: Douglas County, Nevada, General Plan, 1974, p. 17.

LAND USE REGULATION

Douglas County

The Douglas County general plan was adopted in 1975. The plan projected a population for the Carson Valley of 50,000 in the period 1990-2000 and established a residential land use policy that would accommodate up to 21,690 dwelling units, or an equivalent population of 69,970 (Dunau, 1978).

The general plan figure has been disputed. A recent estimate argues that the plan would accommodate between 51,187 and 63,107 dwelling units, or an equivalent population of 153,561 to 183,561. The discrepancy may be in part due to errors in map transcription, different techniques for measuring designated land use areas, the definition of density (gross versus net), the use of intermediate rather than maximum permitted densities, and different figures for persons per household.

Sedway/Cooke prepared another population estimate by traffic zone using gross maximum densities allowable under the general plan. The estimates show an ultimate holding capacity of 26,154 dwelling units or an equivalent population of 78,462, and is shown in Table F-4.

It has also been estimated that the county's zoning ordinance (Douglas County Code, Title 17) would permit an ultimate holding capacity of 53,173 dwelling units or an equivalent population of 159,519 (Dunau, 1978).

The Nevada State Department of Highways also prepared an estimate of the holding capacity permitted by the zoning ordinance by traffic zone (shown in Table F-5). Sedway/Cooke calculated an ultimate holding capacity of 60,275 dwelling units or an equivalent population of 180,825.

The five estimates indicate that existing land use policy would permit anywhere from 21,690 to 63,107 dwelling units or an equivalent population of 69,970 to 183,561.

TABLE F-4

APPROXIMATE BUILDOUT VOLUMES FOR 1975 MASTER PLAN BY TRAFFIC ZONE: STUDY AREA PARTS OF DOUGLAS COUNTY

Traffic Zone	Acres	Dwelling Units	Population*
52	1,863	520	1,560
53	527	532	1,596
54	12,046	5,360	16,080
55	1,690	2,325	6,975
56	1,055	162	486
57	5,594	466	1,398
58	6,842	1,258	3,774
59	7,628	4,180	12,540
60	3,030	2,024	6,072
61	15,085	1,366	4,098
62	11,853	1,138	3,414
63	6,509	1,010	3,030
64	3,200	1,067	3,201
65	12,428	1,121	3,363
66	4,668	1,892	5,676
67	5,005	765	2,295
Subtotal	99,023	25,186	75,558
80	33,554	968	2,904
TOTAL	132,577	26,154	78,462

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*Assumes 3 persons per dwelling unit.

Source: Douglas County, Nevada, Master Plan, 1975.
Calculations of acreage, dwelling units, and population by Sedway/Cooke.

TABLE F-5

APPROXIMATE BUILDOUT VOLUMES FOR EXISTING ZONING BY TRAFFIC ZONES CARSON VALLEY, DOUGLAS COUNTY

Traffic Zone	Acres	Dwelling Units	Population*
52	1,863	1,190	3,570
53	527	1,476	4,428
54	12,046	5,606	16,818
55	1,690	3,128	9,384
56	1,055	451	1,353
57	5,594	1,421	4,263
58	6,842	2,244	6,732
59	7,628	2,871	8,613
60	3,030	2,555	7,665
61	15,085	6,071	18,213
62	11,853	6,772	20,316
63	6,509	2,009	6,027
64	3,200	3,866	11,598
65	12,428	11,392	34,176
66	4,668	2,088	6,264
67	5,005	7,135	21,405
Subtotal	99,023	60,275	180,825
80[2]	33,554		
TOTAL	132,577		

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[1] Assumes 3 persons per dwelling unit.

[2] Information on the zoning of traffic zone 80 was unavailable.

Source: Nevada State Department of Highways, Planning and Survey Division, Carson, Douglas Area Transportation Study, n.d.; Douglas County Zoning Ordinance (Douglas County Code, Tital 17); calculations of dwelling units and population by Sedway/Cooke.

Alpine County

Sedway/Cooke estimated the holding capacity of the study area in Alpine County by taking the higher density permitted by either the plan or zoning. The results are shown in Table F–6. The plan places a substantial area in the SP (special planning) and SP-I (special planning-interim) categories, which imply the use of either specific plans or PD (planned development) zoning, but do not limit uses or overall density. It is conceivable that a development on the scale of the Kirkwood ski resort could be permitted in these areas, although it would involve stringent environmental evaluation and review by the county.

TABLE F-6

APPROXIMATE BUILDOUT VOLUMES UNDER CURRENT LAND USE POLICY BY TRAFFIC ZONE: ALPINE COUNTY[1]

Traffic Zone	Acres with Specified Density	Dwelling Units	Population[2]	Acres Without Specified Density[3]
028101	19,215	6,040	17,516	3,150
028102	3,670	183	530	5,710
028103	3,936	1,411	4,091	624
TOTAL	26,821	7,634	22,137	9,484

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[1] Private land

[2] Assumes 2.9 persons per dwelling unit

[3] UA, SP, SP-I general plan categories; 15 acres zoned PD in Sorensens; and 9 acres zoned RL-A in Markleeville. In addition, greater densities may be obtained on lands zoned AG by the addition of employee housing, or through use permits allowing 1 du/5ac.

Source: Alpine County, General Plan, 1974; Alpine County Zoning Ordinance (No. 243); area calculations and measurements by Sedway/Cooke.

2. TRANSPORTATION

An origin-destination survey (Nevada State Department of Highways, 1972) conducted in 1972 found that 52 percent of the traffic leaving the Minden-Gardnerville area went north on U.S. 395, 28 percent went south on U.S. 395, 11 percent went west on Highway 19 (Kingsbury Grade), and 9 percent went south on Nevada Highway 88. The survey also found that for every nonresident who enters the area to work, 1.6 residents went to jobs outside the area. The ratio of 4.7 resident commuters to one nonresident working in the area was highest on Highway 19, which serves the Stateline casino area. Of the 172 resident vehicles that went north on U.S. 395 to leave the area, 35 (20 percent) had destinations at Lake Tahoe. Through traffic going north and south through the survey area was found to account for about 70 percent of the total survey trips in the Douglas County part of the study area.

3. RECREATION

TABLE F-7

STATE RECREATIONAL FACILITIES: UPPER CARSON RIVER BASIN

Site	Activities	Visitor Days	% Change From Previous Year
CALIFORNIA			
Grovers Hot Springs State Park 460 acres 79 leased (USFS) 539	Camping, Picnicking, Swimming, Fishing, Hiking and Interpretive Trails	89,165 (1976-77)	-15.6%
NEVADA			
Mormon Station Historic Landmark 2 acres	Picnicking, Visitor Center	13,760 (1977) 17,987 (1976)	-23.5%
Lake Tahoe Nevada Recreation Area 13,468 acres total (7,421 within basin)	Sightseeing, No facilities within basin	800,448 (1977)[1] 1,036,700 (1976)[1]	-22.79%

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[1] Most of the visitors probably used the developed facilities in the Lake Tahoe Basin.

4. PUBLIC SERVICES

EXISTING CONDITIONS

Health

Carson-Tahoe Hospital, the only hospital facility in the Upper Carson River Basin, is in Carson City. It is a 77-bed, acute-care hospital that serves the Carson Valley and the eastern part of Alpine County. In 1977 use of the hospital amounted to 22,692 patient days. March was the busiest month, when the hospital operated at 81 percent of capacity. About 20 percent of the patients are transient, 20 percent are from surrounding counties, and 60 percent are from the Carson City area (Carson-Tahoe Hospital, Administrator's Office, pers. comm.). The occupancy ratio (the number of in-patient days divided by the bed days available) has varied between 74 percent and 78 percent over the past five years, which means that the hospital is operating very near its margin of safety.* To meet growing demand, hospital administrators are now planning to add 33 beds. Emergency treatment is provided at the Carson-Tahoe Hospital, which is overcrowded. Users have complained of long waits and high costs and have voiced a demand for a clinic that would provide treatment for illnesses and minor emergencies.

Prevention and detection services are provided by private physicians in Gardnerville and a public health nurse with offices in Minden.

The two private nursing homes in Carson City, with a combined total of 173 beds, are usually full and must maintain waiting lists. The Washoe Medical Center in Reno, 45 miles away, provides tertiary care.

Rehabilitation services are provided through public contract with private therapists who work in the hospital or the patient's home. An expansion of services is needed, but funds are lacking (cost per counselor is $60,000, including overhead).

There are no health education services in either Minden-Gardnerville or Carson City.

Alcoholism and drug abuse counseling services are provided by the Carson City Regional Council. The council accepts patients from Douglas County, but feels it does not have enough funds to meet this need. The only in-patient facilities lie outside the area at the northern end of Lake Tahoe in California and in Fallon in Nevada.

Mental health services are provided through rural clinics, which offer counseling only. The clinic serving Minden-Gardnerville is six months old and is already well used. There are no in-patient facilities.

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*The National Health Planning Guidelines, issued by the Department of Health, Education, and Welfare, recommend a maximum average annual occupancy ratio of 80 percent. This figure, however, applies primarily to large hospital facilities. For smaller facilities, an 80 percent occupancy ratio may mean that only a small number of beds are left unoccupied and that the margin of safety may be inadequate in the event of an emergency. Thus, for smaller hospitals, a lower occupancy ratio is appropriate (Livak, pers. comm.).

The Alpine County Health Department contracts with the state of California for health services. Twice a month, a state health official visits the county. The Alpine County Health Department administers two basic health programs: a nursing program, which provides immunization, venereal disease treatment, child care, and pregnancy care; and an environmental health program, which monitors public services such as sewage disposal, solid waste disposal, and water supply for public health and safety violations. The Health Advisory Board recommends policies and programs for a number of health-related concerns, including alcohol treatment, care for senior citizens, and services delivery.

Schools

In 1977 the Douglas County School District had an enrollment of 2,031 students in its elementary, intermediate, and secondary schools in the Carson Valley area. The district is constructing two new elementary schools in the Carson Valley area and expanding Douglas High School. Thus, by 1981, facilities could accommodate an increase of approximately 1,000 students.

In Alpine County, spring 1978 elementary school enrollment was 134 students. By 1981 enrollment capacity will be 230 students. Secondary school students travel to schools outside the county, most to Douglas High School in Nevada. As a result, Alpine County high school students do not receive a standard California education. The school district has retained consulting services to recommend expansion programs for the future.

Fire Protection

The Insurance Services Office recommends that rural fire protection should be at a 8 rating or better on a scale of 1 to 10 (with 1 being the best service). The major population center in Carson Valley is provided with services rated between 6 and 8. The station at Gardnerville is rated at 6; the Minden station at 7; and other stations at Gardnerville/Ranchos and Minden at 8. Sparsely populated areas of Carson Valley and Alpine County have marginal services rated at 9 (Topaz Lake, Topaz Ranch, Sheriden Acres). The station at Woodfords in Alpine County is not rated.

The U.S. Forest Service and the Nevada Division of Forestry have fire protection jurisdiction throughout the area, primarily to control forest and range fires.

Police Services

In Douglas County the ratio of sworn personnel to residents is about 3.1 per 1,000, substantially higher than the national average for rural areas of 2.1 per 1,000.

The ratio of sworn personnel in the Alpine County Sheriff Department to residents in Alpine County is 8.24 per 1,000, an unusually high--and misleading--figure because of the county's small population. The department actually has seven sworn personnel, to serve the entire county. This is a minimum force required to provide 24-hour service.

Solid Waste

Solid waste management in Carson Valley is provided by the counties, who contract with a private firm, and by the townships of Minden and Gardnerville. The South Tahoe Refuse Company, through its subsidiary, the Douglas Disposal Company, collects solid waste for the parts of Douglas County in the Carson Valley. The townships of Minden and Gardnerville provide their own service. The service area of the Douglas Disposal Company includes 800 residences and 100 commercial establishments in Douglas and Alpine counties (Johnson, pers. comm.).

Solid waste is delivered to the Gardnerville sanitary landfill, which is maintained by the South Tahoe Refuse Company. Under present agreements between the South Tahoe Refuse Company and Douglas County, the waste of local county residents can be deposited at the site at no charge. All other material, such as waste produced in the Lake Tahoe Basin, is assessed a disposal charge.

Until July 1978, Alpine County delivered its waste to a dump at Fredricksburg on land managed by the U.S. Forest Service. Because of Forest Service land use policies, the site was closed. Solid waste is now collected by the Douglas Disposal Company and deposited at the Gardnerville disposal site. The lease with Douglas County is tenuous; Douglas County can negate the contract with Alpine County after a 30-day warning period, and Alpine County has no contingency plan.

MITIGATION MEASURES

Health

1. Expand Carson-Tahoe Hospital.

Description. Expansion should allow for increased bed space, tertiary care, increased emergency facilities, and a 24-hour pharmacy. Could also include facilities for alcoholism, drug abuse, and mental patients.

Effectiveness. Would be the most efficient manner of allocating resources to meet acute care and other needs.

Responsibility. Greater Nevada Health Systems Agency, Nevada State Division of Health, Carson-Tahoe Hospital.

Cost. Variable; would depend on extent of expansion.

Timing. As soon as possible due to existing shortages.

2. Construct primary/intermediate care clinic.

Description. Some action in this area is necessary in order to meet existing demand; such a clinic would free hospital resources, as it could serve many hospital functions with fewer resources and at a lower cost.

Effectiveness. Could be highly effective if built; would be a response to strong community demand.

Responsibility. Greater Nevada Health Systems Agency, Douglas County, Nevada State Division of Health.

Cost. Variable; would depend on facilities and timing.

Timing. Variable; would depend especially upon plans for expansion of the hospital.

3. Initiate and/or expand county health programs.

Description. There is a strong need for growth in these services, but funding is a problem. Reallocation of resources to encourage volunteer help might be a solution (see measure 4 below).

Effectiveness. Success would depend upon county-wide response, acceptance of the County Health Department and on volunteer participation.

Responsibility. Douglas County, local residents, Greater Nevada Health Systems Agency.

Cost. Would require funding for equipment and perhaps space for new programs.

Timing. Due to existing shortages, programs for education and alcoholism and drug abuse counseling should begin as soon as possible.

4. Encourage volunteer services.

Description. Volunteer services can accommodate a great deal of need in relation to their monetary input and can encourage funding from a number of sources. Additionally, they tend to be more flexible than institutions and can often be more responsive to community needs.

Effectiveness. This can depend upon the specific area to which the service will be applied and the level of skills necessary. May depend upon acceptance by local agencies and upon local attitudes.

Responsibility. Local citizens would carry most of the responsibility, but government agencies must be responsive to their needs (see measure 3 above); Greater Nevada Health Systems Agency.

Cost. Variable.

Timing. Variable.

Schools, Fire Protection, and Law Enforcement

5. Direct growth to areas with excess school capacity and where police and fire departments can take advantage of service delivery efficiencies resulting from increased population.

Description. Major savings could result if spillover population is directed to areas where school facilities are operating with excess capacity. Per-unit operation costs would be lowered, and the construction of new capital facilities could be deferred until the capacity of existing classrooms and personnel is fully utilized.

To the extent that growth would occur as infill or adjacent to already developed areas, the per-unit costs of police and fire services would likely be lowered. The need for additional fire stations could be reduced if growth could be directed to areas within reasonable response time from existing stations.

Effectiveness. Could be effective depending upon ultimate level of growth.

Responsibility. Douglas County Planning Department, public service agencies, and regional and local governments.

Cost. Administrative, if planning is done prior to major investment decisions.

Timing. Should be coordinated with Douglas County General Plan update.

6. Institute double sessions or year-round school operations to reduce need for additional school facilities.

Description. Double session and year-round school operations would reduce need for additional schools to accommodate increased enrollments, and would thereby reduce or defer new capital expenditures. The per-unit fixed costs of operating school facilities would be lowered, but the per-unit variable costs (including personnel costs) would remain constant if student-teacher ratios remained constant.

Effectiveness. As variable operating costs are most of the total school costs, the overall cost reduction resulting from a double session or year-round school schedule may not be significant.

Responsibility. Douglas County School District.

Cost. See "Effectiveness" above.

7. Coordinate land use planning and capital facilities planning and budgeting.

Description. Given the low level of urbanization in Carson Valley, the potential for coordinating land use planning and capital facilities planning is high. Long-range land use planning permits distribution and level of future service requirements to be evaluated so that costs may be anticipated and minimized.

Effectiveness. Could be highly effective if planning were done prior to major investment decisions.

Cost. Primarily administrative.

Timing. Should be coordinated with capital facilities planning and Douglas County General Plan update.

8. Adopt a system of regional tax-base sharing.

Description. A system of regional tax-base sharing could be instituted to equalize the potential of local areas to collect revenues to pay for services provided. Such a system might begin by sharing the increase in tax base arising from new development. Under a tax-sharing system, revenues generated from commercial development in south shore might assist agencies in Carson Valley faced with service demands from spillover population.

Effectiveness. Whereas this measure may be effective in minimizing fiscal impacts, it may create political problems and may not be feasible without statutory changes.

Responsibility. Federal, state, or regional agencies could undertake a study of the need for such measures and develop a workable system for regional agencies. Responsibility for implementation would be determined as part of this study.

Cost. Undetermined. Should be examined as part of feasibility study described above.

Timing. Study could begin as soon as facility plan alternatives and associated growth scenario are chosen.

9. Use volunteer personnel for law enforcement and fire protection.

Description. The use of volunteer personnel may result in lower per-unit service costs. As Carson Valley becomes more urbanized, however, the use of full-time, paid personnel may become more desirable, especially if permanent staffing results in quicker response times, improved insurance ratings, and lowered insurance premiums. Volunteer personnel could then be used more efficiently during peak-demand periods.

Effectiveness. Could be effective, especially during peak demand periods.

Cost. Would include the cost of training volunteers; could result in reduced per-unit service costs.

Timing. As needed.

10. Require contributions from developers for capital facilities such as schools and fire stations.

Description. Per-unit price service costs could be reduced if capital facilities are included in private costs of development.

Effectiveness. Such measures would likely result in higher housing costs, and would therefore conflict with housing affordability goals.

Responsibility. TRPA, Douglas County, service agencies.

Cost. Depends on extent of enforcement.

Timing. Would require change in development permit policy.

Solid Waste

11. Expand present services by increasing equipment and labor to handle projected solid waste volumes.

Description. At this time, collection services in the Upper Carson River Basin are adequate, but Douglas Disposal Company and the towns of Minden and Gardnerville should begin to plan for the volumes anticipated under the different scenarios, especially Scenarios 4 and 5.

Effectiveness. Would depend on ability of the private sanitation company and the towns of Minden and Gardnerville to finance service expansion.

Responsibility. Douglas Disposal Company, towns of Minden and Gardnerville.

Cost. Would depend on number of additonal trucks required, frequency of pick ups, and the increase of the labor force.

Timing. Service should be expanded to accommodate future growth.

12. Initiate public education and volunteer programs to reduce amount of solid waste generated, promote a clean, litter-free community, and achieve the state goal of a 25 percent reduction of waste going to the landfill.

Description. The Douglas County Solid Waste Management Plan calls for the establishment and implementation of continuing public and industry information and litter control programs in 1979.

Effectiveness. Waste reduction would depend on how actively the programs are promoted.

Responsibility. Local governments, chambers of commerce, citizen action groups, schools, private businesses.

Cost. No cost to the local government if conducted on a volunteer basis. Only costs are those associated with publicity and education.

Timing. Should be consistent with county solid waste management plans.

5. UTILITIES

EXISTING CONDITIONS

Energy

The main suppliers of energy in the Upper Carson River Basin are the Sierra Pacific Power Company, which provides electricity, and the Southwest Gas Corporation, which provides natural gas. A number of residences and commercial establishments use liquefied petroleum gas, heating oil, and wood for space heating, cooking, and water heating. Users of miscellaneous energy sources are typically in areas outside of the urban concentrations of Carson City, Minden, and Gardnerville. The energy supply system is shown in Figure D–4, in Lake Tahoe Basin "Utilities."

Electricity. The Sierra Pacific Power Company supplies electricity to the Carson Valley through two substations in the Minden-Gardnerville area, which includes 4,363 customers. The electricity is generated outside of the area and transmitted in through a station near Carson City. Growth in the area has caused demand for electricity to increase. Non-coincident peak loads at the Minden and Pinenut substations, serving the Carson Valley, are over 60 percent of the substation capacity. Service to Alpine County is provided via a 17.5 kV distribution circuit out of the Minden substation.

Natural Gas. The Southwest Gas Corporation supplies some areas of the Upper Carson River Basin with natural gas purchased from the Northwest Pipeline Company. The main transmission line divides near Carson City: one branch goes northwest toward Incline Village, serving the Carson City area along the way; the second branch goes southwest toward Stateline, serving the Minden-Gardnerville area along the way. The only other areas in the Upper Carson River Basin that receive natural gas are Genoa and Jacks Valley. A total of 1,208 customers are served in these areas (plus an additional 2,395 in the Nevada side south of the Lake Tahoe Basin).

Mild winters during the past few years have allowed Southwest Gas to accommodate additional growth without taxing its capacity. However, current capacity is inadequate to serve peak demand, which would occur during a period of extreme cold. To increase the capacity of the system, Southwest Gas is constructing a loop line that will parallel its existing line along U.S. 395. In addition, the company is seeking approval to construct a liquefied natural gas (LNG) storage facility east of Carson City. Gas not sold by Southwest Gas can be converted to LNG and stored at the facility for use during peak demand or emergencies. The project must receive approval from the Federal Energy Regulatory Commission and several state agencies, including the Public Service Commission.

Liquefied Petroleum Gas. There are five main suppliers of liquefied petroleum gas (primarily propane) to the Upper Carson River Basin: Petrolane, Cal Gas, M & E, Pargas, and Mound House. Local distributors operate out of the Carson City and the Gardnerville areas. The dealers in Gardnerville also supply communities in Alpine County such as Markleeville and Woodfords. Although the price of propane has risen substantially over the past few years, users find this fuel source readily available. The alternative to using liquefied petroleum gas would be to switch to heating oils, which are less expensive but much dirtier fuels. To use heating oils, homeowners would be required to change their furnaces from gas burners.

G. EXISTING INSTITUTIONAL AND POLITICAL FRAMEWORK IN LAKE TAHOE HYDROGRAPHIC BASIN

This appendix contains the following sections:

I. OVERVIEW OF PLANNING AND MANAGEMENT INSTITUTIONS AND LEGISLATION

FEDERAL PLANNING, MANAGEMENT AND INSTITUTIONAL FRAMEWORK

Federal Responsibility

- Environmental Protection and Coordination.
- Management of Federal Lands
- Water Resource Development
- Transportation

Federal Institutions

- Environmental Protection Agency
- Bureau of Reclamation (U.S. Dept. of Interior)
- Bureau of Land Management (U.S. Department of Interior)
- Forest Service (U.S. Department of Agriculture)
- Soil Conservation Service (U.S. Department of Agriculture)
- Geological Survey (U.S. Department of Interior)
- Corps of Engineers (U.S. Department of Defense)
- Fish and Wildlife Service (U.S. Department of Interior)
- Heritage Conservation and Recreation Service (Department of Interior)
- Federal Highway Administration (U.S. Department of Transportation)
- Bureau of Indian Affairs

BI-STATE PLANNING, MANAGEMENT AND INSTITUTIONAL FRAMEWORK.

Tahoe Regional Planning Agency

Areawide Waste Treatment Management Program (208 Planning)

Comprehensive Planning Assistance Program (701)

California-Nevada Water Compact.

CALIFORNIA PLANNING, MANAGEMENT, AND INSTITUTIONAL FRAMEWORK

Land Use and Environmental Planning

- Office of Planning and Research
- State Water Resources Control Board
- Regional Water Quality Control Boards
- Department of Water Resources (State Resources Agency)
- Department of Fish and Game

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- Department of Parks and Recreation
- State Lands Commission
- Air Resources Board
- Solid Waste Management Board
- Substate Solid Waste Management Plans
- California Tahoe Regional Planning Agency
- Tahoe Conservancy Agency
- City and County Institutions
- Public Utility Districts

NEVADA PLANNING, MANAGEMENT AND INSTITUTIONAL FRAMEWORK

Land Use and Environmental Planning

- Governor's Office of Planning Coordination
- State Environmental Commission and Division of Environmental Protection
- Division of Water Planning
- Division of Water Resources
- Division of State Lands
- Division of Conservation Districts
- Division of State Parks
- Department of Highways
- Department of Fish and Game
- Division of Health
- Water Conservancy Districts
- Drainage Districts
- Irrigation Districts
- Flood Control Districts
- Conservation Districts
- Local Jurisdictions

Wastewater Treatment

- Counties
- Municipalities
- General Improvement Districts
- Public Health
- Cooperative Planning Arrangements
- Wastewater Treatment Systems

2. LEGAL ISSUES

WATER RIGHTS

Current Legal and Actions Concerning Water Supply in the Truckee-Carson River Basins

- United States v. Alpine Land and Reservoir Company
- Pyramid Lake Paiute Tribe of Indians v. Morton

United States v. Truckee-Carson Irrigation District, et. al
Truckee-Carson Irrigation District v. Secretary of the Interior
City of Fallon, et al; v. Secretary of the Interior

ENFORCEMENT OF WATER QUALITY STANDARDS

EPA Enforcement Proceeding against DCSID No. 1

Lahontan Regional Water Quality Control Board Enforcement Proceedings Against South Tahoe Public Utility District

I. OVERVIEW OF PLANNING AND MANAGEMENT INSTITUTIONS AND LEGISLATION

The following is a discussion of major federal, bi-state, California and Nevada standards, regulations, and institutions concerned with planning for sewage treatment facilities.

FEDERAL PLANNING, MANAGEMENT, AND INSTITUTIONAL FRAMEWORK

Federal Responsibility

Environmental protection and coordination and the management of federal lands, water resource development, and transportation are the primary activities of the federal government important to this study. The following discussion outlines the basic responsibility of federal government in the study area.

Environmental Protection and Coordination. The National Environmental Policy Act of 1969 (NEPA), (PL 91-190) requires all federal agencies to give full consideration to environmental effects in planning and carrying out their programs. NEPA spells out the national environmental policy, requires the preparation of environmental impact statements on certain projects, and calls for the establishment of the Council on Environmental Quality. The interpretation of NEPA has taken place in the federal court system.

The Federal Water Pollution Control Act Amendments of 1972 (FWPCA) (33 USC s 1281), Section 208, provides for the development and implementation of area-wide waste treatment management plans for all point and nonpoint sources of pollution. It requires that these plans provide for the best practicable waste treatment technology and consider advanced waste treatment techniques.

The FWPCA, Section 201, also authorizes the Environmental Protection Agency (EPA) to make grants to states, municipalities, intermunicipalities, or interstate agencies for the construction or improvement of publicly owned waste treatment works. Grants for waste treatment facilities will not be made unless the grant application demonstrates that innovative and alternative wastewater treatment processes and disposal methods have been fully studied and evaluated.

Management of Federal Lands. Federal lands in the Lake Tahoe Basin and Upper Carson River Basin are managed primarily by two federal agencies, the U.S. Forest Service, and the Bureau of Land Management (BLM).

According to the Forest Service Organic Administration Act of 1897, the national forests are established "to improve and protect the forest. . . , for the purpose of securing favorable conditions of water flow, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States." This multiple use concept has continued under the Multiple-Use and Sustained-Yield Act of 1960 and the Sustained Yield Forest Management Act. The Forest Service also is subject to the provisions of NEPA, as are all federal agencies.

On April 2, 1976, the Forest Service and EPA issued a joint policy statement for cooperation among the Forest Service, EPA, and state and areawide water quality management agencies to meet the requirements of FWPCA, Section 208.

The BLM administers the nation's natural resource lands. These are the unappropriated, unreserved, residual lands of the United States. The Federal Land Policy and Management Act of 1976 (PL 94-579) is the primary legislation dealing with the management of these lands.

The act requires the Secretary of the Interior to maintain an inventory of all public lands and resources. The secretary also must develop land use plans for the use of the public lands. BLM plans must comply with 208 areawide wastewater management plans in the area. The act states that the public lands should be managed to protect the quality of scientific, scenic, historical, ecological, environmental, air, water, and archaeological resources. The BLM also develops recreational resources and makes land available through sale to individuals, organizations, local governments, and other federal agencies.

Water Resource Development. The federal government has taken a strong role in water resource development. It has built flood control works, irrigation projects, and hydroelectric facilities; regulated the use of navigable waters; taken the lead in river basin planning; imposed standards of water quality; collected and disseminated data and information; and granted funds for water-related projects.

The federal agencies most involved in water resource construction activities are the Army Corps of Engineers, the Bureau of Reclamation, and the Soil Conservation Service.

Authority for federal participation in water resource development comes directly from the federal constitution. Specific projects depend upon statutory authority and appropriations. Other federal statutes such as NEPA and FWPCA may impose restrictions upon water resource development projects.

Transportation. The federal government is involved through financial assistance or industry regulation in practically all forms of transportation. Most of the federal transportation programs fall within the Department of Transportation (DOT) created by the Department of Transportation Act of 1966. The agencies under DOT include the Federal Highway Commission, Urban Mass Transportation Administration, and Federal Aviation Administration.

Federal transportation planning and assistance takes place pursuant to a number of statutes. Some of the more significant are the Federal-Aid Highway and Revenue

Acts of 1956, the Federal-Aid Highway Act of 1970, the Federal-Aid Highway Act of 1973, the Urban Mass Transportation Act of 1964, the Urban Mass Transportation Assistance Act of 1970, and the Airport and Airway Development Act of 1970.

Federal Institutions

Principal federal institutions in the study area are discussed below.

Environmental Protection Agency. In addition to many other activities, the Environmental Protection Agency (EPA) administers the FWPCA. The FWPCA requires EPA to create a system of "permits" to regulate the discharge of pollutants into the navigable waters of the United States.

One of the primary objectives of the FWPCA is to restore and maintain the chemical, physical, and biological integrity of navigable waters. National goals have been established that would eliminate the discharge of pollutants into navigable waters by 1985 and that would achieve water quality sufficient for the protection and propagation of fish, shell fish, and wildlife, and for recreation.

To achieve these objectives, the FWPCA established procedures and criteria for setting water quality standards and a timetable for compliance that can be implemented and enforced by state and federal agencies. The California legislature in the Porter-Cologne Act adopted the timetable established under the FWPCA for meeting water quality goals. The timetable is as follows:

- By July 1, 1977, all publicly owned waste treatment works in existence must meet effluent limitations or schedules for compliance established by state or federal law or regulation.
- By July 1, 1983, all publicly owned treatment works must comply with requirements set forth in the act by application of the best practicable waste treatment technology.

Although the act contains a national goal of no pollutant discharge, its enforcement provisions do not require the complete elimination of pollutants. Rather, they require the elimination of pollutants that adversely effect the quality of water necessary to support the beneficial use of the water as defined by applicable regulatory bodies.

EPA also has authority under the Safe Water Drinking Act (PL 95-523), to set national drinking water quality standards, which are enforced by the states.

Bureau of Reclamation (U.S. Department of Interior). Within the study area, the Bureau of Reclamation has many responsibilities. It works in conjunction with many agencies on the Newlands Project, which provides for irrigation in the lower Carson Valley near Fallon, in Western Nevada. It is also responsible for maintaining the top 6 feet of Lake Tahoe as a reservoir, and has control of the Lake Tahoe Dam in Tahoe City, which is the outlet into the Truckee River.*

The bureau is also involved in the proposed development of the Washoe Project, a part of the Lahontan Basin development plan. The Washoe Project is comprised of the Watasheamu and Stampede divisions. The Watasheamu Dam and Reservoir on the East Fork Carson River about 10 miles south of Gardnerville, in Douglas County, Nevada, has been authorized for construction. The reservoir will extend into Alpine County, California. The dam project is a response to the need for additional irrigation water in the Carson Valley. Releases from the reservoir will also be used for power generation while the reservoir will provide flood control and a new recreation site.

The Dressler diversion dam and afterbay on the East Fork Carson River about 4½ miles downstream from Watasheamu Dam have been proposed by the bureau.

The Stampede Division will further develop the Truckee River Basin and Lower Carson River Basin. This division will develop water supplies for municipal and industrial uses and measures for fish and wildlife enhancement. It will aid in restoring fishing in Pyramid Lake. The division will also be responsible for flood control and recreational facilities.

Bureau of Land Management (U.S. Department of Interior). In 1973, the BLM entered into a cooperative agreement with the South Tahoe Public Utility District (STPUD) to construct and maintain recreational facilities adjacent to the Indian Creek Reservoir in Alpine County. (STPUD was required to construct, maintain, and operate these facilities under a Davis-Grunsky Contract with the State of California.) STPUD is responsible for maintaining the level of the reservoir and its water quality.

BLM is responsible for 69 percent of the entire land area of the state of Nevada. (Combined federal agencies own or manage 85 percent of the entire land area of the state.) Of the 5,344,928 acres under the control of the Carson City District of BLM, 179,718 acres lie within Douglas County, and 45,725 acres lie within Alpine, Lassen, Mono, and Plumas counties in California.

Forest Service (U.S. Department of Agriculture). The U.S. Forest Service manages the national forests and cooperates with state and local governments. Its authority is derived from the following legislation:

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*To maintain the reservoir function of the lake, the Bureau acquired 64 acres adjacent to Tahoe City with the intention of constructing an auxillary outlet from Lake Tahoe if it became necessary. Under a 1926 contract, however, the bureau allowed the Truckee Carson Irrigation District to operate the Newlands Reclamation District. The bureau is currently attempting to regain control of the 64 acre parcel to transfer the property to the U.S. Forest Service. This matter is currently being litigated in federal court.

Act of February 1, 1905 (33 Stat. 628; 16 U.S.C. 472).
Organic Act of June 4 1897 (30 Stat. 34-36; 16 U.S.C. 473-78).
Multiple Use-Sustained Yield Act of June 12, 1960 (74 Stat. 215; 16 U.S.C. 528-31).
Sustained Yield Forest Management Act (16 U.S.C. 583-583j).
Forest and Range Land Renewable Resources Planning Act of 1974 (88 Stat. 476; U.S.C. 1601-1610).
National Forest Management Act of 1976 (PL 94-588).

The federal ownership of lands in the Lake Tahoe Basin amounts to 64 percent of the entire area. National forest lands in the Lake Tahoe Basin lands are managed by the Lake Tahoe Basin Management Unit (LTBMU) of the U.S. Forest Service. Those lands include the Toiyabe, Eldorado and Tahoe national forests. The area includes parts of Alpine, El Dorado, and Placer counties in California, and Carson City and Douglas and Washoe counties in Nevada.

The Forest Service has authority to acquire and hold lands, provided that such lands are within the national forest boundaries. Lands may be acquired in fee, by exchange, or by donation.

The Forest Service has produced the Multiple Use Management Plan for National Forest Lands in the Lake Tahoe Basin, which guides management of all national forest lands in the area. This plan is now being revised.

Soil Conservation Service (U.S. Department of Agriculture). The Soil Conservation Service (SCS) is responsible for developing a soil and water conservation program in cooperation with landowners and operators and governmental agencies. Technical assistance is given in the form of soil surveys, flood hazard management studies, and other soil or water studies and surveys. The basic legislation of SCS is the Soil Conservation Act of 1935 (49 Stat. 163; 16 U.S.C. 590a-f).

The SCS works through the Douglas County Conservation District on matters related to agricultural runoff and other soil and water concerns. The SCS is involved in a coordinated flood insurance study for Douglas County in connection with the National Flood Insurance Program.

The SCS has a field office in the Lake Tahoe Basin, which works closely with the Tahoe Resource Conservation District, the Nevada Tahoe Conservation District, the City of South Lake Tahoe, Douglas County, El Dorado County, TRPA, and other federal, state, and local agencies.

Resource Conservation and Development districts (RC & D) established through federal legislation are eligible for federal funds for erosion control on a cost-sharing basis. Through such programs it is possible for the SCS to be more actively engaged in implementing soil conservation and erosion control plans.

Only a small portion of the Lake Tahoe Basin lies within a RC & D, and that area is within Douglas County. Legislation is pending in Congress that would designate the entire Lake Tahoe Basin a RC & D district.

The SCS was actively involved in the 208 Areawide Wastewater Management Planning Program undertaken by TRPA. SCS helped to develop the 208 handbook on best management practices.

Geological Survey (U.S. Department of Interior). The U.S. Geological Survey (USGS) is a data gathering service of the U.S. Department of Interior, and is charged with conducting surveys of topography, geology, mineral resources, and water resources in the United States.

The USGS undertakes continual studies of the elevation and flow out of Lake Tahoe. The survey monitors Trout Creek, Ward Creek, the upper reaches of the Truckee River, Fallen Leaf Lake, Fallen Leaf Creek, and Blackwood Creek.

The USGS in conjunction with the Carson Valley Conservation District is undertaking a special study to develop a model of sediment transport in the East Fork of the Carson River. Additionally, continuous stream flow and sediment studies are conducted along the East Fork Carson River at Gardnerville and Minden, and the Carson River at Genoa. The USGS monitors the West Fork Carson River in Alpine County.for continuous stream flow into the Carson Valley. Third Creek is monitored for continuous stream flow in the Incline Nevada Area.

Corps of Engineers (U.S. Department of Defense). The Corps of Engineers undertakes major federal water resources development projects. These projects include flood control, water supply, recreation, and hydroelectric power facilities.

The Corps of Engineers has regulatory powers under the River and Harbors Appropriation Act of 1899 and the FWPCA, Section 404, to require permits for work on the nation's navigable waterways, or for discharging, dredging or filling material in the nations navigable waterways. The Corps must approve all proposed piers and structures in Lake Tahoe.

Fish and Wildlife Service (U.S. Department of Interior). The Fish and Wildlife Service is responsible for improving and maintaining fish and wildlife resources. The service is also responsible for administering the Endangered Species Act of 1973.

The service has authority under the Native Environmental Protection Act, the FWPCA, and the Fish and Wildlife Coordination Act to review the impacts of proposed developments on fish and wildlife. The service also has authority under the Rivers and Harbors Act to review requests for dredging permits from the Corps of Engineers.

Heritage Conservation and Recreation Service (Department of Interior). The Heritage Conservation and Recreation Service (HCRS), formerly the Bureau of Outdoor Recreation,is responsible for reviewing and evaluating environmental impacts of federal projects on cultural resources, national landmarks, and recreation. Together with the Bureau of Reclamation, the Corps of Engineers, and other state and federal agencies, it helps to develop comprehensive river basin studies.

The HCRS administers the Land and Water Conservation Fund, which makes federal funds available to the U.S. Forest Service for acquisition of lands, and to state and local governments for acquiring and developing lands for parks and recreation. This fund is the major federal source of money available for the acquisition and development of parks and recreational facilities.

The HCRS works with the General Services Administration to help the federal government transfer surplus federal lands to state and local governments for parks and recreation.

Federal Highway Administration (U.S. Department of Transportation). The Federal Highway Administration is responsible for administering the Federal Aid Highway Act of 1968. Under this act, the federal government finances 90 percent of the cost of constructing the National System of Interstate and Defense Highways and 70 percent of the cost of other federally assisted highways.

The Federal Highway Administration provides technical and financial assistance to the state of California through the California Department of Transportation (CALTRANS), and to the state of Nevada through the Nevada Highway Department.

In the Lake Tahoe Basin, the administration has cooperated with CALTRANS and the Nevada Highway Department in various research activities concerning the impacts on streams and vegetation of the Lake Tahoe Basin from road salting, erosion control techniques, and the after effects of highway construction.

Bureau of Indian Affairs. The Bureau of Indian Affairs (BIA) serves as trustee for Indian lands as part of its more general responsibility to assist Indians. The BIA does not actually manage or administer any lands in the Lake Tahoe Basin.

In the Upper Carson Valley, near Woodfords/Markleeville, the BIA serves as a trustee of various public-domain allotments along the West Fork of Carson River. The size of these scattered allotments ranges from 40 to 160 acres. Additionally, there are various tribal holdings in the Upper Carson River Valley.

Along the East Fork Carson River, Nevada State Highway 335, the BIA administers the Washoe Ranches. This land contains three points of diversion from the East Fork Carson River.

BI-STATE PLANNING, MANAGEMENT, AND INSTITUTIONAL FRAMEWORK

Tahoe Regional Planning Agency

The Tahoe Regional Planning Agency (TRPA) is a nonmetropolitan areawide planning agency created as a distinct political subdivision of the states of California and Nevada. TRPA was created by a compact between the states of California and Nevada, and was ratified by the United States Congress on December 18, 1969, under PL 91-148.

The authority granted by the compact is extremely broad in the areas of land use and environmental policy: TRPA was established as "...an areawide planning agency with power to adopt and enforce a regional plan for resource conservation and orderly development, to exercise effective environmental controls and to perform other essential functions..." (Article I, (c)). The compact further provides that "all provisions of the Tahoe Regional General Plan shall be enforced by the agency and by the states, counties and cities in the region." (Article V (c)), and that "all ordinances, rules, regulations and policies adopted by the Agency shall be enforced by the Agency and by the respective states, counties and cities." (Article VI, (b)). TRPA is required to prepare and adopt a regional plan for Tahoe that consists of the following elements:

- land use plan
- transportation plan
- conservation plan
- recreation plan
- public service and facilities plan

In addition, the compact also mandates development and enforcement of all necessary rules, regulations, ordinances, and policies to implement the regional plan. Specifically, the compact calls for regional standards in the following areas:

- water purity and clarity
- subdivision
- zoning
- solid waste disposal
- sewage disposal
- landfills
- excavations
- cuts and grading
- piers, harbors, breakwaters, channels, and other shoreline development
- waste disposal in shoreline areas from boats
- mobile home parks and house relocations
- outdoor advertising
- floodplain protection
- soil sedimentation control
- air pollution
- watershed protection

Federal, state, and local governmental entities are represented in the planning and decision-making processes of TRPA. By specific reference, the compact establishes representation on the TRPA governing body for the federal government, the governors of each state, the director of the Resources Agency in each state, and all six local governments in the region. The compact also created a technical advisory committee which is made up of representatives of state and federal agencies with major interests in the region and the six local governments and some citizen members. The commission reviews and makes recommendations to the governing board on all agency plans, ordinances, and amendments and on all public works projects and Office of Management Budget A-95 clearing house matters.

Despite the strong powers given TRPA to carry out the mandates of the compact, the agency's authority is limited in several areas:

- TRPA has no condemnation or taxation powers. As a result, TRPA has had no power to compensate property owners whose property may have been devalued as a result of the environmental controls applied by TRPA.
- TRPA operates under a "dual majority" rule, whereby projects are automatically approved if a majority of both states do not vote to disapprove.
- The TRPA board has no control over gambling development in Nevada.
- Inadequate funding restricts effective enforcement of regulations.
- TRPA is limited to advisory comments on state public works projects. Thus, although the compact requires the states to comply with the plans of TRPA, state agencies can proceed with projects even if TRPA disapproves of them.

Several aspects of the bi-state compact have been the subject of controversy, and it is now under amendment. The changes in the compact being considered are:

- To give TRPA authority over new gaming development, casino expansion, and casino rebuilding in the Lake Tahoe Basin.
- To adopt and apply National Environmental Policy Act.
- To revise TRPA voting procedures and the compact provision that requires a development project to be deemed approved if the Nevada and California delegations fail to agree on either approval or denial of the project.
- To change the composition and number of TRPA board members.
- To require uniform enforcement of TRPA planning regulations by state and substate agencies.
- To reexamine the role of CTRPA and its various plans and ordinances after compact amendments have been made.

Areawide Waste Treatment Management Program (208 Planning)

In August 1974, EPA approved the designation by the governors of California and Nevada of TRPA as the areawide planning agency with the mandate to develop and insure the implementation of an Areawide Waste Treatment Management Program for the Lake Tahoe Basin in California and Nevada, as authorized under Section 208 of the FWPCA.

The purpose of the 208 planning program in Lake Tahoe is to address nonpoint sources of pollution in the designated area. The planning program also addresses other water quality needs for management of municipal waste waters, solid wastes, and watercraft wastes.

TRPA submitted its 208 planning document, the Lake Tahoe Basin Water Quality Management Plan to the California State Water Resources Control Board (SWRCB) and the Nevada Division of Environmental Protection (NDEP). The plan consists of four main elements:

- Water Quality Problems and Management Program
- Handbook of Best Management Practices
- Assessment of Water Quality and Environmental Impacts, and
- Plan Development

On May 23, 1978, the State of Nevada conditionally approved certification of the plan by EPA. On July 20, 1978, the SWRCB opposed certification of the plan and proposed the de-designation of TRPA as the areawide planning agency for areawide waste treatment management.

Under the authority of the NDEP, the plan was submitted for certification by EPA. By November 1, 1978, the SWRCB will take further action on its proposed de-designation of TRPA depending on the results of revisions to the Bi-State Compact concerning TRPA planning and enforcement powers. If TRPA were de-designated, it would fail to qualify for federal funding to implement and enforce the plan on the California side of Lake Tahoe Basin, and the SWRCB would be responsible for implementing the plan or for designating a new agency.

Comprehensive Planning Assistance Program (701)

The Department of Housing and Urban Development designated TRPA as the agency to undertake a 701 Comprehensive Planning Assistance Program Study for the Lake Tahoe Basin. Accordingly, TRPA has prepared the following documents:

- Comprehensive Regional Planning Program: Overall Program Design 1973-1975
- Regional Capital Programming Element
- Regional Housing Element
- Regional Open Space Element
- Financial Feasibility: Implementation of the Tahoe Regional Plan

California - Nevada Water Compact

The California-Nevada Water Compact between the state of California and the state of Nevada was created to provide equitable distribution and use of the waters of the Truckee, Carson, and Walker rivers and the waters of Lake Tahoe in both states. The compact has allocated 34,000 acre-feet of water annually for use in the Lake Tahoe Region (23,000 acre-feet to California and the remaining 11,000 to Nevada). In addition, the compact has recognized and preserved the existing judicial decisions and decrees that govern water use in the Truckee and Carson River basins. Although agreed upon by both states, the compact has not yet been ratified by Congress.

CALIFORNIA PLANNING, MANAGEMENT, AND INSTITUTIONAL FRAMEWORK

This section describes California agencies and institutions which perform two major functions--land-use/environmental planning and waste treatment.

Land Use and Environmental Planning

Office of Planning and Research. The Office of Planning and Research (OPR) is responsible for comprehensive land use and environmental policy planning. The legislative intent in establishing OPR was to guide state's growth through an effective planning process within the framework of statewide goals and policies. OPR is responsible for insuring the orderly development and implementation of environmental policy. OPR does not have any direct implementation or regulatory power over land use, public works, or other state, regional, or local programs.

State Water Resources Control Board. The State Water Resources Control Board (SWRCB) is authorized to establish and implement state water quality policy under the Porter-Cologne Water Quality Control Act enacted by the California legislature in 1969. The board coordinates the water rights, water pollution, and water quality functions of the state and is primarily responsible for discharge water quality standards and for administering all programs of state and federal aid for the elimination of water pollution.

State policies for water quality control and regional water quality control plans become a part of the California Water Plan. The state policy for water quality control consists of the following:

- Water quality principles and guidelines for planning, including groundwater and surface water management programs and control and use of reclaimed water.

- Water quality objectives for planning and operation of water resource development projects and for water quality control activities

- Other principles and guidelines deemed essential by SWRCB for water quality control.

The SWRCB in connection with the Clean Water and Water Conservation Finance Committee is also authorized to administer the Clean Water and Water Conservation Bond Law of 1978 (California Water Code Section 13955 et seq.). The purpose of this law is to increase use of reclaimed and conserved water, to augment existing water supplies, and to provide necessary funds to insure compliance with the FWPCA.

Regional Water Quality Control Boards. California is divided into nine water basins (regions), each under the administrative planning and regulatory authority of a substate Regional Water Quality Control Board (RWQCB). A regional board is composed of nine part-time members appointed by the governor to four year terms. Each RWQCB is authorized to adopt, implement, monitor, and enforce regional water quality control plans, prescribe waste discharge requirements, and perform other functions concerning water quality within their respective regions, subject to the review and approval of the SWRCB.

Water quality powers vested in the regional boards, excluding planning powers discussed separately below, include the following:

1. A regional board may establish requirements for all present or proposed waste discharges not flowing into the community sewer system. Such discharge requirements "shall implement" relevant water quality control plans "if any have been adopted" and consider protection of beneficial uses, regional water quality objectives, other waste discharges, and prevention of nuisances. The discharge requirement process is activated by the mandatory filing of a report with a regional board describing any material change or proposed change in the character, location, or value of waste discharges. However, a discharge requirement cannot specify the design, location, type of construction, or particular method by which compliance is to be achieved.

2. The discharge requirement system is supported, in event of a violation, by authority in a regional board to issue a cease and desist order requiring either immediate compliance or compliance according to a detailed time schedule. Cease and desist orders may be enforced by a court injunction and/or a civil fine up to $6,000 per each day of violation. The boards may also issue cleanup and abatement orders. Cease and desist orders may also be issued regarding volume, type or concentration of wastes discharged into a community sewer system.

3. A regional board has the authority to coordinate action in water quality control, including prevention and abatement of water pollution and nuisances; encourage and assist in self-policing waste disposal programs; require technical investigations by local and state agencies regarding water quality control; request enforcement of water quality laws; and recommend projects for financial assistance to the SWRCB.

Each regional board is to formulate and adopt a regional plan incorporating, among other things, water quality control objectives ensuring the "reasonable" protection of beneficial uses and prevention of nuisances.

The regional plans are also to contain an implementation program, a time schedule, and surveillance measures to insure compliance.

The planning process is based on the substate to state or "bottom up" approach in which regional plans are first to be adopted by the regional boards and then by the state board. The regional plans required by the Porter-Cologne Act are to be superseded in event of conflict by water quality control plans required for the state by the FWPCA.

The Lake Tahoe Basin is within the Lahontan Region and is governed by the Lahontan Regional Water Quality Control Board (Lahontan RWQCB).

The Porter-Cologne Act (California Water Code, Section 13950), explicitly prohibits discharge of any waste within the Tahoe Basin, regardless of quality. Specific provisions are found in the California Water Code, Section 13951, allowing very limited exceptions to the export requirement where the Lahontan RWQCB finds that the continued operation of septic tanks, cesspools, or other means of waste disposal in the area will not directly or indirectly affect Lake Tahoe's water quality and that the sewering of such area would have a damaging effect upon the environment.

Specific provisions in the California Water Code, Section 13951, are made for areas within the Fallen Leaf Lake watershed to permit nonconformity with the basic waste export requirement for toilet wastes by single-family residences or commercial properties under the same criteria for exceptions set forth in the above paragraph.

The FWPCA provides that permits may be issued by states which are authorized to implement the provisions of such act. Under the Porter-Cologne Act, as amended in 1972, California accepted responsibility for the regulation of the permit system controlling the discharge of pollutants to the navigable waters of the United States within the jurisdiction of this state. "Permits" as used in the FWPCA are equivalent to the term "waste discharge requirements" used under California law.

Any person either proposing to or presently discharging pollutants or proposing any material change in discharge must file a report of such discharge with the regional board of that region.

Department of Water Resources (State Resources Agency). The Department of Water Resources (DWR) is under the State Resources Agency. DWR's regulatory and rule-making power is shared with the California Water Commission, a nine member body appointed by the governor with senate approval. DWR's primary purpose is the enhancement of water resources for domestic consumption and recreation.

DWR's functions include: conserving, developing, and transporting the state's water resources; overseeing the State Water Project, the aqueduct, and the California Water Plan; conducting investigations and hearings on the availability of water supplies for export from the watersheds of origin and reporting to the legislature;

planning for public recreational uses and fish and wildlife preservation as part of its general project development activities for water facilities; undertaking studies for construction of projects needed for groundwater protection and advising localities on these projects.

The DWR administers programs of financial assistance to public water suppliers. The DWR administers the California Safe Drinking Water Bond Law of 1976 under rules and regulations adopted with the advise of the State Department of Health Services. The DWR administers the Davis-Grunsky Act.

Department of Fish and Game. The Department of Fish and Game, under the State Resources Agency, is established under the Fish and Game Code and governed by a five member Fish and Game Commission. The commission was created in 1940, with its members appointed by the governor subject to senate confirmation. It is authorized to regulate the taking or possession of birds, mammals, fish, amphibians, and reptiles except for commercial purposes, and is to promulgate rules and regulations relating to the state's fish and wildlife. It is empowered, among other things, to review and approve proposed projects involving the acquisition of land and water for ecological reserves.

The department prepares and is primarily responsible for the implementation of a state fish and wildlife plan.

In the study area, the department is responsible for enforcing laws governing fishing, hunting, and wildlife protection. The department also has a management program for Lake Tahoe Basin, which governs the planting and tracking of fish, monitoring the fish catch, and monitoring water quality.

In the Upper Carson Valley, the department has a similar management plan for Indian Creek Reservoir whereby the department maintains the reservoir for the beneficial use of fishing and monitors the reservoir for water quality. The department also has responsibility for general fish and game law enforcement. The department is particularly concerned about wildlife problems associated with proposed development of dams, reservoirs, and subdivisions in Alpine County.

In addition to its enforcement and implementation activities, the department has environmental review responsibilities over proposed permits granted by the Corps of Engineers, activities of the State Lands Commission, the Tahoe Regional Planning Agency, the Lahontan RWQCB, the State Division of Forestry, and other agencies affecting environmental quality and natural resources.

Department of Parks and Recreation. The Department of Parks and Recreation is an executive department within the State Resources Agency and operates under policies set by the nine-member Parks and Recreation Commission appointed by the governor and subject to senate confirmation.

The department has broad powers for acquiring,administering, developing, planning, and operating parks and recreation facilities in the state.

The Department manages six units in the study area, five along Lake Tahoe--Emerald Bay State Park, Sugar Pine Point State Park, Tahoe State Recreation Area, D.L. Bliss State Park, and Burton Creek State Park, and one in Alpine County--Grover Hot Springs State Park.

The department has general environmental review powers under the California Environmental Quality Act, the Davis-Grunsky Act, the National Historic Preservation Act, and other environmental protection and natural and historic preservation laws.

The department participates with the federal Heritage Conservation and Recreation Service in administering the Land and Water Conservation Fund.

State Lands Commission. The State Lands Commission has exclusive responsibility for administering ungranted and unpatented public lands owned by the state under its control, including vacant school lands, tidelands, submerged lands, swamp and overflowed lands, and beds of navigable rivers and lakes. It has statutory power to sell, lease, or dispose of land under its jurisdiction, provided that the transaction is in "the public interest" and is authorized to approve or disapprove permits for the private use of state lands, such as pier development in the lake. It has broad powers to exchange state tidelands and submerged lands for publicly or privately owned lands. The commission has no power to acquire land for the state beyond acquisition of an easement to inaccessible public land for the purpose of facilitating its sale.

The commission serves as guardian over navigable waters for public commerce, fishing, or navigation. In this capacity, the commission manages use of the Lake Tahoe bed, and must approve all proposals for private pier construction.

In the study area, the commission has granted permits or made leases with various public agencies for use of lands within its jurisdiction. Any use of state lands under the commission's jurisdiction proposed by the South Tahoe Facility Plan must be approved by the commission.

The commission has recently completed a study in conjunction with the Corps of Engineers and the State of Nevada on cumulative impacts of activities in Lake Tahoe such as pier development. This study determined areas of the lake that are environmentally sensitive and may lead to creation of specific zones for use and development of the lake shoreline.

Air Resources Board. In response to federal legislative initiative requiring establishment of a single state agency for air pollution control, the Mulford-Carrell Air Resources Act of 1967 created the state Air Resources Board (ARB). It is responsible for administration, research, development of standards and coordination of air pollution activities. ARB is the designated state agency responsible for implementing the federal Clean Air Act which includes establishing air quality standards as well as air basin and state implementation plans. As the state air pollution control agency, it is to oversee substate stationary source controls and to enforce local standards and regulations when necessary. The board administers the state's program for the control of motor vehicle emissions while stationary source control remains "the prime responsibility" of the substate Air Pollution Control Districts.

California is divided into 13 designated air basins. The study area falls into the Lake Tahoe Air Basin. The Lake Tahoe Air Basin currently is a non-attain ment area for photochemical oxidants and carbon monoxide.

A non-attainment plan is currently being prepared in a bi-state effect by the California ARB and the Nevada Division of Environmental Protection.

Solid Waste Management Board. The Solid Waste Management Board (SWMB), a single-purpose planning agency, was charged with developing a statewide solid waste management policy, a research and development program, and related information and research activities. Its jurisdiction was explicitly circumscribed by a legislative policy "that the primary responsibility for adequate solid waste management and planning shall rest with local government." The state role in solid waste matters was declared to be basically one of policy and program development.

The state board was required to adopt by January 1975, and thereafter periodically review and revise, a state policy for solid waste management. The policy is to include minimum standards for solid waste handling and disposal for the protection of air, water, and land from pollution.

Substate Solid Waste Management Plans. The state board was instructed to provide guidelines and necessary technical assistance for the preparation of substate solid waste plans. Each county, in cooperation with affected local jurisdictions, must prepare a solid waste management plan that is consistent with the state policy as well as any regional or subregional solid waste plans.

The substate plans are to be submitted to the state board for approval as to their compliance with the state policy for solid waste management.

California Tahoe Regional Planning Agency. In 1967 the California legislature declared the waters of Lake Tahoe and other resources of the Lake Tahoe region to be threatened with deterioration. The California legislature therefore enacted legislation creating the California Tahoe Regional Planning Agency (CTRPA). CTRPA was created as a "political subdivison (Cal. Govt. Code § 66801), and is empowered to pass ordinances rules, regulations, and policies which are to be enforced by the agency, the state of California, and the counties and cities within its jurisdiction.

CTRPA's jurisdiction includes that part of Lake Tahoe within California, the adjacent parts of El Dorado and Placer counties lying within the Lake Tahoe Basin and an adjacent part of Placer County outside the basin (Cal. Govt. Code § 67021).

CTRPA is empowered to prepare a regional plan with the following elements:

- land-use plan
- transportation plan
- conservation plan
- recreation plan
- public services and facilities plan.

CTRPA is authorized to adopt ordinance, rules, regulations, and policies to effectuate its plans. Specifically, the agency is to regulate regional standards for the following:

- subdivision
- zoning
- tree removal
- solid waste disposal
- sewage disposal
- land fills, excavation, cuts and grading
- piers
- harbors
- breakwaters
- channels, and other shoreline developments
- waste disposal in shoreline areas
- waste disposal from boats
- mobilehome parks
- house relocation
- outdoor advertising
- flood plain protection
- soil and sedimentation control
- air pollution
- watershed protection.

CTRPA and the cities and counties in the region are given authority to enforce the Tahoe Regional Plan.

CTRPA currently exists under its original mandate; however, with passage of AB 1944 in 1973, its membership was increased from 5 members to 7 members. CTRPA generally exercises the same review authority as TRPA, and additionally reviews public works projects in California.

Tahoe Conservancy Agency. With passage of AB 1944 on October 1, 1973, in the California legislature, the California Tahoe Conservancy Agency was created. It is composed of five public members, appointed by the governor, with responsibility and authority to acquire and hold real property in the California portion of the basin. AB 1944 authorizes the appropriation of funds for acquisition. The agency may acquire interests in land by means of exchanges and may accept land and cash gifts and donations from public and private sources. Management of the lands so acquired will be performed by contract with other public agencies. The agency has not been funded to date.

City and County Institutions. The following cities and counties in the study area are responsible for land-use planning and zoning, building inspections and permits, public works, public and environmental health services, including drinking water and waste treatment planning, community development, and local parks and recreation within their respective jurisdictions:

- Alpine County
- El Dorado County
- Placer County
- City of South Lake Tahoe

In developing their land use programs and strategies of implementation within the Lake Tahoe Basin, these jurisdictions must specifically coordinate their actions with plans, policies and ordinances of the TRPA General Plan.

Public Utility Districts. Public utility districts are governed by the Public Utility District Act (California Public Utility Code, Section 15501 et seq.).

The districts are governed by an elected board of directors consisting of as many members as there are territorial units in the district and as many additional members, not less than three nor more than four, as are required to constitute a board composed of an odd number of directors (Cal. Pub. Utilities Code § 15951). Officers of the district are appointed by the board of directors.

The board is authorized to pass ordinances fixing charges for the commodities services furnished by the district to pay the expenses of the government of the district. The expenses to be paid include: interest on any indebtedness incurred for the acquisition, construction, and completion of the utility.

It is the intention of the act that a district pay all of such charges and expenditures and the interest and principal of its debt from the revenues derived by the district from the operation of its public utilities, and that each public utility owned and operated by a district shall be self-sustaining.

A public utility district has a duty to serve property within its geographically defined scope of service with the types of utility services which it provides.

Under the statutory framework of California law governing public utility districts as well as general case law, a district may not be absolutely compelled to provide new service to property lying within the district's geographical scope of service.

It is clear, howver, that districts have an absolute duty to attempt to provide service and when they fail to do so, the district must make its best efforts to find ways to provide such service.

The ability of a district to provide wastewater treatment services is controlled by several factors. The district must be able to finance its wastewater treatment facilities while at the same time complying with applicable limitations on indebtedness and local, state and federal environmental standards.

Any wastewater treatment facility has a limited capacity, i.e., ability to treat sewage and wastewater while complying with governmental standards concerning water, air, soil standards. When considering its ability to expand the facilities by which wastewater is treated, the district must actively recognize the range of environmental quality standards.

The South Tahoe Public Utility District (STPUD) was incorporated in 1950, and in 1955 its sewage treatment plant became operative.

STPUD is responsible for wastewater disposal and sewage treatment for 25,000 acres around the south shore of Lake Tahoe between Emerald Bay and the California Nevada Stateline in El Dorado County. The district also provides domestic water supply for 40 percent of the area. To comply with California water law requirements prohibiting disposal of wastewater into Lake Tahoe or its watershed, since 1968 STPUD has exported wastewater from the Tahoe Basin to Diamond Valley in Alpine County into the Indian Creek Reservoir. A trout fishery has been established in the reservoir, and water from the reservoir is used each summer by downstream farmers for irrigation.

Discharge of waters into Indian Creek Reservoir is governed by the waste discharge requirement (NPDES Permit) issued by the Lahontan RWQCB.

STPUD functions under various contracts with federal, state and local agencies. The major contracts are as follows:

- Contract with Alpine County for the Indian Creek Reservoir
- Contract with the Bureau of Land Management for recreational facilities at the Indian Creek Reservoir
- Contract with the State of California under the Davis-Grunsky Act financing the Indian Creek Reservoir
- Contract with the U.S. Forest Service for reserve capacity
- Contract with the state Department of Parks and Recreation for reserve capacity at Emerald Bay State Park
- Memorandum of understanding concerning the provision of sewage collection facilities at Fallen Leaf Lake by 1979

- Contracts with various improvement districts in the district for California
- Obligations concerning the servicing of bonds issued to finance plant development and expansion.

NEVADA PLANNING, MANAGEMENT, AND INSTITUTIONAL FRAMEWORK

This section describes Nevada State and substate agencies and institutions which perform two major functions--land use/environmental planning and waste treatment.

Land Use and Environmental Planning

Governor's Office of Planning Coordination. The Nevada Governor's Office of Planning Coordination is responsible for planning coordination in the state and for determining major goals for the various state agencies. Nevada does not have a state equivalent to the National Environmental Policy Act or the California Environmental Quality Act. Planning and management are generally delegated to local government, which must comply with state enabling legislation and state-adopted standards.

State Environmental Commission and Division of Environmental Protection. State water and air quality standards, rules and regulations are set by the State Environmental Commission, under the Department of Conservation and Natural Resources. State and substate agencies must act consistently with these standards (Nevada Water Pollution Control Law, NRS Chapter 445.131).

The primary responsibility for monitoring and enforcement of the standards rests with the Division of Environmental Protection. The Division of Environmental Protection monitors the 208 programs for the four designated areas in Nevada and is responsible for preparing the 208 plan for nondesignated areas in the state. (TRPA was responsible for developing the 208 wastewater planning program and its implementation on the Nevada side of the Lake Tahoe Basin.) The division has authority to issue NPDES permits for the discharge of pollutants and is responsible for the administration of federal grants and loans under the FWPCA. The division also must approve all systems for sewage treatment and disposal. It can enforce its authority by issuing a compliance order, by initiating a civil action or by requesting that the attorney general begin a criminal prosecution.

The division has final authority over any state agency or department, municipal corporation, county, or other political subdivision in the administration of water pollution, abatement, and control.

The Nevada legislature responded to the need for stringent protection of Lake Tahoe and its watershed with legislation aimed at prohibiting discharge of pollutants into the lake and its watershed and prohibiting activities likely to disturb the natural ecology of the area.

Discharging sewage or other wastes into Lake Tahoe or within 100 feet of the established high water rim of Lake Tahoe, or within 100 feet of a stream, reservoir, spring, well or other water supply in the Lake Tahoe watershed is prohibited (NRS Chapter 445.090, Section 1) However, where disposal of sewage or other waste, by reason of property characteristics, topography, or other limitations, cannot be provided other than within 100 feet of Lake Tahoe, then the Nevada Department of Conservation and Natural Resources is authorized to issue a permit for installation and operation of such sewage works as may be necessary to provide protection to the lake and its watershed (NRS Chapter 445.090 Section 22).

The Environmental Commission is authorized to adopt regulations to carry out the purpose and intent of the above. The Department of Conservation and Natural Resources is charged with enforcing the regulations. Permits may be granted allowing a person a beneficial use of treated effluent within the Lake Tahoe watershed under a permit issued pursuant to the Nevada Water Pollution Control Law (NRS Chapter 445.131 to 445.354).

In January 1971, the governor of Nevada issued an executive order prohibiting the use of septic tanks in the Lake Tahoe Basin after December 31, 1972.

Division of Water Planning. The Division of Water Planning under the Department of Conservation and Natural Resources is responsible for water resource planning for the state. The division has been designated the state agency to receive funds from the U.S. Water Resources Council.

The divison has no direct regulatory responsibilities, but it does work with the Division of Water Resources in coping with the chronic water shortage in Nevada and also cooperates with the State Conservation Commission, the Division of Historic Preservation and Archaeology, the State Board of Health, and the U.S. Geological Survey in the development of their various programs as they relate to or are affected by water resource planning.

The Division of Water Planning assists subdividers and industry in coping with water shortages and developing alternative sources of water. The division is constantly searching for new sources of water and develops forecasts of water supply and demand. The division also monitors state water law developments to protect the state's interest in water use.

The division is currently engaged in two statewide projects: a study of water conservation projects, and an analysis of the land application of wastewater and overall effects on groundwater quality.

The division also conducts environmental reviews of federal, state, and local projects affecting water resource development.

Division of Water Resources. The Division of Water Resources in the Department of Conservation and Natural Resources shares primary responsibility with the Division of Water Planning for water resource development in Nevada. The primary purpose of the division is to determine and implement procedures to achieve effective use of the state's water resources.

The state engineer has authority over changes in the flow of water caused by the construction and operation of dams, levees, channels, and flow diversion facilities. The State Board of Health has the authority to adopt and enforce regulations to protect water supplies.

The Division of Water Resources is responsible for issuing all groundwater well permits except for domestic wells with capacities of less than 1800 gallons per day. The division offers information on water rights, the construction and maintenance of dams, and flood control. The regulatory function of the division includes permits and certification, as well as the physical distribution of water. The division also conducts resource inventories of water availability and use.

Division of State Lands. The State Land Use Planning Act (NRS Chapter 321.640 - 321.810) designates the Division of State Lands, a division of the Department of Conservation and Natural Resources, as the state land use planning agency. The division consists of the Lands Office and the state Land Use Planning Agency. The agency is charged with developing a statewide land use planning process and coordinating its planning process with the planning activities of local, state, and federal agencies and the regulatory activities of state agencies.

The agency also has the authority to designate, with concurrence of the governor, areas of critical environmental concern, defined as "any area in this state where uncontrolled development could result in irreversible degradation of more than local significance" (NRS Chapter 321.660). A plan must be adopted by the agency for the use of land, water, air space, and other natural resources within the areas.

Division of Conservation Districts. The Division of Conservation Districts under the Department of Conservation and Natural Resources coordinates and assists local conservation districts in erosion control and soil conservation. The division is primarily concerned with the state's renewable natural resources not otherwise delegated to other state institutions.

The Division of Conservation Districts helped to formulate the 208 wastewater management program for nondesignated parts of the state for "nonpoint" sources of pollution, and developed "best management practices."

The division works with such institutions as the Soil Conservation Service, the Bureau of Land Management, and the U.S. Forest Service, and has general environmental review responsibilities.

Division of State Parks. The Division of State Parks, under the Department of Conservation and Natural Resources is charged with operating and maintaining the State Park System. The division has no regulatory authority outside of the boundaries of the State Park System.

The division operates and maintains two parks in the study area: the Lake Tahoe-Nevada Recreation Area and Mormon Station.

Department of Highways. The Department of Highways is primarily responsible for transportation planning and development within the state.

Department of Fish and Game. The Department of Fish and Game is responsible for promoting and protecting fish and wildlife resources and their habitat in the state. The staff carries out the policies set by the commissioner of the State Board of Fish and Game. Anyone desiring to use vacuum or suction dredge equipment must obtain a permit from the department. The department monitors water quality in streams thorughout the state for substances that may be harmful to fish and wildlife.

Division of Health. The Division of Health, under the Department of Human Resources is responsible for the quality of water supplies. The division is responsible for implementing the federal Safe Drinking Water Act (PL 93-523).

All subdivision maps or plans for sewage disposal, water pollution, water quality and water supply facilities must be approved by the division.

Water Conservancy Districts. Water conservancy districts (NRS Chapter 541.040) control unappropriated water for domestic, manufacturing, irrigation, power, and other beneficial uses. Water conservancy districts may also undertake irrigation, flood control, drainage, safety, and health projects.

The districts have broad powers to acquire and sell water rights, exercise the power of eminent domain, and construct and maintain public works. They can also contract with governmental units and collect taxes and special assessments in order to maintain and operate public works.

Drainage Districts. Drainage districts (NRS Chapter 540.030) have the power to examine lands proposed to be drained, advertise construction work for bids, and assess benefits and damages to property. Taxes to implement drainage projects are levied by the county assessor. These districts possess bonding authority. Drainage districts do not undertake construction or operation activities.

Irrigation Districts. Irrigation districts (NRS Chapter 539.020) have legal authority to use eminent domain, appropriate water, regulate the distribution of water in the district, generate and transmit electric power, contract and cooperate with state and federal agencies, and assess charges. The Truckee-Carson Irrigation District performs these functions in connection with the Newlands Project.

Flood Control Districts. Flood control districts (NRS Chapter 543.170) may be created by the Board of County Commissioners in counties with populations of 100,000 or more. Such districts may acquire, construct, improve, maintain, and operate flood and storm water control projects. They may conserve and reclaim waters for beneficial purposes. Flood control districts also may cooperate with state and federal agencies for the construction and operation of flood control projects. The districts may charge connection fees, levy and collect taxes, and issue bonds.

Conservation Districts. Conservation districts (NRS Chapter 548.370) may undertake surveys and research, engage in demonstration projects, and carry out preventive and control measures in the district. Operational projects can include cooperative efforts between agencies and private owners in conserving renewable natural resources in the district. Conservation districts also may construct, operate, and maintain facilities and structures, prepare comprehensive conservation plans, and enforce land use regulations related to resource conservation and soil erosion control. The Nevada Tahoe Conservation District performs these functions in the study area.

Local Jurisdictions. State enabling legislation for local land use planning and regulations is found in NRS Chapter 278. This chapter deals with planning, zoning, and subdivision regulations. All counties and incorporated cities are required to adopt master plans. The master plan may be expanded to include other elements which relate to the physical development of the city, county or region.

All counties and cities are required to adopt zoning and subdivision regulations. Zoning must be in accordance with the master plan. Subdivision refers to the division of land into five or more lots or parcels, any of which is less than 40 acres. A city or county cannot approve a tentative subdivision map unless it finds that the subdivision will not result in undue water or air pollution. Another required finding is that the subdivisin is in conformance with the adopted master plan. Planned unit developments are authorized pursuant to the provisions of NRS Chapter 280A. The planned unit development procedure allows the county or city greater flexibility in locating structures.

Douglas County is the only Nevada county in the study area. There are no incorporated cities in Douglas City. All functions performed by towns are delegated to them by the Douglas County Commissioners.

Douglas County is generally governed by the Douglas County Commissioners. The many departments under the commissioners are responsible for general land use planning, zoning, subdivisions, public works, public health, parks and recreation, building inspections and permits, and other functions.

In developing its institutional programs and strategies of implementation within the Lake Tahoe Basin, Douglas County must specifically coordinate its actions with plans and policies of the TRPA Regional General Plan and its various ordinances. (See PL 91-148, Article V(c) and VI(b).)

Wastewater Treatment

Counties, municipalities and general improvement districts are authorized to undertake wastewater treatment operations. The Nevada Division of Environmental Protection issues discharge permits to these agencies, which are responsible for planning and implementing treatment improvements necessary to meet water quality standards.

Counties. Broad authority for counties to plan for and operate waste treatment facilities is found in NRS Chapter 224. In addition to this authority, counties may adopt ordinances and regulations necessary or convenient for the operation and use of the facilities (NRS Chapter 244.9243(5)). Counties greater than 200,000 in population are empowered to become the master agency in its territory for the collection, disposal and treatment of sewage and wastewater and are authorized and directed to develop an areawide waste management plan (NRS Chapter 244.9262). The county is required to adopt all necessary ordinances, regulations and policies to effectuate the adopted area plan. The county also is required to insure that all local political subdivisions within the county enforce the adopted ordinances, regulations and policies (NRS Chapter 244.9263). Waste management plans are to implement waste treatment management requirements of the FWPCA, Section 201(c), 33USC § 1281(c). The 208 plan prepared by TRPA fulfills this requirement for the Lake Tahoe Basin part of Douglas County.

Municipalities. Incorporated municipalities are generally authorized to construct and operate waste treatment facilities (NRS Chapter 266.261, NRS Chapter 267.395, and NRS Chapter 271.265). Unincorporated areas have similar general powers (NRS Chapter 271.265).

General Improvement Districts. General improvement districts have broad authority for the construction and operation of various public services, including waste treatment facilities (NRS Chapter 318.116). These districts are created by county governments. Special rules are prescribed if districts are proposed to include lands within seven miles from the boundary of either an incorporated or unincorporated municipality.

A general improvement district may compel owners of inhabited property within the district to use the district services instead of using some other type of service. A district may acquire or improve any system for sewage disposal only after obtaining approval from the County Board of Health (NRS Chapter 318.170).

Public Health. Each county in the state may establish a county board of health. City boards of health also may be established. A county board of health is required to make any regulations necessary for the public health, including sanitation regulations. The county regulations are subject to approval by the State Board of Health. The county boards of health have the authority to abate nuisance in accordance with the law.

Cooperative Planning Arrangements. Local agencies may enter into cooperative planning arrangements pursuant to NRS Chapter 277.045 for the performance of any governmental function. NRS Chapter 277.060 provides that local agencies in a county having a population of 100,000 or more may enter into a contractual agreement concerning water and sewage facilities.

The Interlocal Cooperation Act (NRS Chapter 277.080 through 277.180) permits public agencies to enter into joint exercise of power agreements. "Public agency" includes cities, counties, special districts, state and federal agencies, and Indian tribes.

Wastewater Treatment Systems. There are six wastewater treatment systems in the study area which perform wastewater treatment. They are described below. The Douglas County Sewer Improvement District No. 1 (DCSID #1) is responsible for collecting wastewater from the Stateline area of Lake Tahoe and for the treatment and disposal of all wastewater within the Lake Tahoe Basin portion of Douglas County.

DCSID #1 has contracts to treat wastewater from the following collection districts:

- Kingsbury General Improvement District,
- Round Hill General Improvement District,

- Elk Point General Improvement District,
- Tahoe-Douglas General Improvement District

Since the discharge of waste into Lake Tahoe or the Lake Tahoe watershed is restricted under Nevada law, all effluent is exported over Daggett Pass through an export pipeline, the terminus of which is in Douglas County in the East Fork Carson River under the Muller Lane Bridge.

Minden-Gardnerville Sanitation District serves the towns of Minden and Gardnerville. Effluent is discharged into the East Fork Carson River upstream from the DCSID outfall.

Three other small wastewater treatment systems serve the area. The Gardnerville Ranchos system serves part of this subdivision south of Minden-Gardnerville. The Stewart Indian School has its own system, and effluent is discharged to Clear Creek, tributary to Carson River. The Medium Security Prison has oxidation ponds and also discharges effluent to Clear Creek. The latter two systems are expected to be terminated in the near future.

Incline Village Improvement District in the Lake Tahoe Basin discharges treated effluent to Carson River downstream of the DCSID outfall during winter months.

2. LEGAL ISSUES

WATER RIGHTS

Current Legal Actions Concerning Water Supply in the Truckee-Carson River Basins

United States v. Alpine Land and Reservoir Company, Civil No. D-183, U.S.D.C., Nevada. The United States initiated this action for declaratory relief in 1925, to establish its storage diversion right to the Lahontan Reservoir in relation to pre-1902 upstream diversion rights and to adjudicate the surface flows of the main stem of the Carson River. The Court issued an order in 1949, which states, among other things, the purposes for which water may be used: irrigation, power, municipal uses, storage, reclamation of arid lands, stock watering, domestic and other beneficial uses. The relationship between the ground and surface waters in the watershed and the flows of the tributaries and water rights established after 1940 are not included in the order.

The duty of water after transportation losses is 2.92 acre-feet per acre annually for irrigation use. This duty of water is inconsistent with the duty of water set in the Orr Water Ditch Decree for the same lands. Such Decree determines the use of the waters of the Truckee River in the Newlands Project. This inconsistency remains unresolved.

In 1950 a new Restraining Order identical to the 1949 Order was entered to remain in effect until modified. Recently the Truckee -Carson Irrigation District has appeared on behalf of its water users and the United States has appeared on behalf of the Fallon Indian Tribe. The Court is presently engaged in an attempt to reach a final decree.

Pyramid Lake Paiute Tribe of Indians v. Morton (354 F. Suppl. 252 D.D.C. 1972). The Pyramid Lake Indian Tribe filed the above suit in the Federal District Court in Washington D.C.. The suit was filed after many years of unsuccessful efforts to achieve a compromise in the dispute over the amount of Truckee River water that could be diverted for use in the Newlands Project and the Indians' right to retain sufficient water in the Lower Truckee River to maintain the present level of Pyramid Lake and reestablish its fishery.

The Tribe asserted that it had well-founded rights to the waters of the Truckee River which flowed onto its reservation and into Pyramid Lake. It claimed that the water right included sufficient water to maintain the level of the lake and re-establish its fishery, in both the lake and the Truckee River. The Tribe also claimed that support for this position is found in the purpose that Congress expressed in Section 4 of the Washoe Project Act of August 1, 1956 (70 Stat. 775). The Tribe stated that the lake had receded 80 feet since the construction of the reclamation project, and that flows in the Truckee River had been reduced to the extent that the fishery of the lake had been destroyed.

The Tribe further asserted that the trust responsibilities of the Secretary required him to make certain that the water diverted from the River by the project was restricted to that amount which had been legally decreed to the reclamation project. The Tribe claimed the Secretary was acting arbitrarily and capriciously and was setting an annual operating criteria that permitted excessive diversions of water into the reclamation project.

The court found that the Tribe's claims to sufficient water to maintain the lake and its fishery were well founded and that water was being wasted by the project. It also found that the Secretary was arbitrarily permitting water in excess of legally decreed rights to be diverted by the project to the detriment of the Indians' lake. The Court held that the trust responsibilities of the Secretary required him to assert his full statutory and contractual authority to "formulate a closely developed regulation" for the operation of the reclamation project that would preserve water for the Tribe's lake. Doubt was to be resolved in favor of fulfilling the trust responsibility due the Tribe. The Court then issued an option and an Order establishing the operating criteria for the Newlands Project for the 1973 and 1974 water years. That opinion defined the duties of the Secretary vis-a-vis his trust responsibilities towards the Indians and their lake and his responsibility toward the reclamation project and its water users. The Court's decree, with its criteria, defined such responsibility in terms of the operations of the Newlands Reclamation Project and limitations upon the use of the waters from the Truckee River.

United States v. Truckee-Carson Irrigation District, et al. (Civil No. R-2987 U.S.D.C. Nevada). The United States filed the above entitled action in Federal District Court in the State of Nevada in December 1973 following the Pyramid Lake Paiute Tribe case cited above.

This suit seeks to quiet title of the United States held in trust for the use and benefit of the Pyramid Lake Tribe of Paiute Indians, to sufficient water in the Truckee River to maintain the long-term level of Pyramid Lake and to permit the re-establishment of the fishery in the Lake and in the Truckee River. Other reserved rights for the benefit of federal lands are also asserted.

Truckee-Carson Irrigation District v. Secretary of the Interior, (Civil No. R-34-74 U.S.D.C. Nevada). The Truckee-Carson Irrigation District (TCID) operates the Newlands Reclamation Projects, including Derby Dam which controls flows from the Truckee River pursuant to a 1926 contract with the Bureau of Reclamation. After the Secretary of the Interior adopted and published the Court-ordered operating criteria for 1973 and 1974 water years, the TCID failed to comply with the provisions of the operating criteria. The Court Order required the Secretary to invoke the termination provisions of the 1926 contract if substantial violations of the operating criteria occurred.

TCID claimed that it is not bound by the Department's adoption and publication of the operating criteria, and continued its course of conduct. On September 14, 1973, the Secretary, pursuant to the provisions of the contract and the Court's Order gave TCID notice that its contract would be terminated as of October 31, 1974. That letter also gave notice that the Department of the Interior would take back operation of the Newlands Reclamation Project on that date. The TCID filed the above suit in an effort to (a) avoid the effect of the operating criteria set by the Court and adopted as a regulation by the Department; (b) prevent the termination of its 1926 contract; and (c) avoid the federal government from assuming management of the project. A motion for summary judgment filed by the United States was denied June 9, 1976. The matter continues to be litigated.

City of Fallon, et al;, v. Secretary of the Interior (Civil No. 74-10 U.S.D.C. Nevada). The City of Fallon, (which is surrounded by the Newlands Reclamation Project, Churchill County, Nevada where the project is located,) and various water users sued the Secretary of the Interior under the National Environmental Policy Act (NEPA). They seek to prevent the Department of the Interior from reclaiming the Newlands Reclamation Project and seek to prevent enforcement of the Department's operation criteria until the requirements of NEPA are complied with.

The TCID - not the Department of the Interior - was operating the project and it was not following the operating criteria. The Secretary stated by affidavit that he would not take over the project without a court order permitting him to do so. Parties to this action have agreed that a hearing on the Petition for Preliminary Injunction should be postponed indefinitely, at least until the principle question in Truckee Carson Irrigation District v. Secretary, supra. had been decided.

ENFORCEMENT OF WATER QUALITY STANDARDS

The following represents a sampling of cases currently pending or actions of agencies in effect which seek to enforce applicable water quality standards, and federal and state legislation.

EPA Enforcement Proceeding Against DCSID No. 1

United States v. Douglas County Sewer Improvement District No. 1 and the State of Nevada. (Civil R-78-0123, USDC, Nevada). This action was brought against DCSID No. 1 and the State of Nevada on August 1, 1978. On August 3, 1978, the Natural Resources Defense Council, Inc. filed a motion to intervene in the action with further counts under NEPA.

The action brought by the United States is based on alleged violations of the standards and limitations contained in the NPDES permit granted to DCSID No. 1, and on violations of the Order, and standards and limitations contained therein, issued by the Administrator of the Nevada Division of Environmental Protection. The alleged violations involve operation of the Round Hill waste treatment facility and effluent discharged from the facility into the East Fork of the Carson River.

Lahontan Regional Water Quality Control Board Enforcement proceedings against South Tahoe Public Utility District

On April 26, 1977, the Lahontan RWQCB issued a cease and desist order constraining STPUD from discharging wastes contrary to waste discharge requirements under the NPDES. Monitoring conducted by the Lahontan RWQCB indicated that STPUD was not complying with effluent limitations and receiving water limitations. Furthermore, the order identified that there was discharge of waste to the Lake Tahoe hydrological unit from the Luther Pass Pump Station, and there was also unrestricted public access to the emergency sewage effluent storage pond of STPUD.

On March 9, 1978, the Lahontan RWQCB amended its prior order to allow STPUD to connect new building projects provided the total sewer units for such projects did not exceed 54,000 gallons or the equivalent of 200 single family dwelling units, whichever was less.

The Lahontan RWQCB found that an increase of 32,670 gallons per day in the discharge will not increase the magnitude of violations or the likelihood of violations of the discharge requirements. On June 8, 1978, the Board amended its prior orders reducing the number of projects for which sewer connections may be made. The total number of sewer units for these projects may not exceed 32,670 gallons per day or 121 single family dwelling units, whichever is less.

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PERSONAL COMMUNICATIONS

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Alpine County Sheriff Department

Ames, Laurel. California Tahoe Regional Planning Agency.

Antonucci, David. Lahontan Regional Water Quality Control Board.

Arnold, Gayle. U.S. Fish and Wildlife Service.

Badger, Rich. Golden Empire Health Systems Agency.

Baker, N. Caltrans, District 03, Marysville, California.

Barr, Don. Greater Nevada Health Systems Agency.

Barrett, Bobby. Gardnerville Garbage.

Beer, Jack. California Resources Agency, Department of Fish and Game.

Bendure, Ted. Nevada Department of Conservation and Natural Resources, State Conservation Commission.

Bissell, Germaine. Tahoe Regional Planning Agency.

Blume, Steve. Sierra Pacific Power Company.

Boand, Steve. California Tahoe Regional Planning Agency.

Bostrom, Kyle. Secretary, Kingsbury Fire District Board.

Cahill, Carl. Washoe County Health Department, Environmental Services Division.

Campbell, James. Consultant on Alpine County, California, General Plan, Noise element.

Canning, Gerald. Sierra Pacific Power Company.

Carson-Tahoe Hospital.

Christensen, Glenn. Nevada State, Department of Fish and Game.

Clauson, Larry. Douglas County Sheriff Department.

Cofer, James. South Tahoe Public Utilities Districts.

Conradt, Robert. Transportation Consultant.

Crow, John. Chief of Police, South Lake Tahoe.

Culbert, Dav. Nevada Employment Security Division, Research Division.

Davis, William. Lahontan Regional Water Quality Control Board.

DeAmezaga, Evelyne. Tahoe Research Group, University of California, Davis.

Ellis, Darwin. Fire Chief, Douglas County Fire Department.

Farg, Frank. California State, Department of Fish and Game.

Frantz, Ted. Nevada State, Department of Fish and Game.

Goldman, Charles. Tahoe Research Group, University of California, Davis.

Harjes, Gloria. Nevada Museum of Natural History.

Herron, Gary. Nevada State, Department of Fish and Game.

Hoefer, John. U.S. Forest Service.

Holmes, Tom. Nevada State, Office of State Engineer, Carson City, Nevada.

Hoose, Pete. Assitant Fire Chief, Tahoe Douglas Fire District.

Hygren, Myrl. Health Planning and Human Resources, Nevada.

Ingram, James. El Dorado County Planning Department.

Jackson, George. Nevada State, Department of Energy.

Jauregui, Miguel. Southwest Gas Corporation.

Jeffress, Jim. Nevada State, Department of Fish and Game.

Johnson, Warren. South Tahoe Refuse Company.

Leonard, Robert. Tahoe Research Group, University of California, Davis.

Leslie, Jene. Director, Tahoe Valley Airport.

Livak, Joe. Health Planning and Human Resources, Nevada.

Lockwood, Doug. California State, Solid Waste Management Board.

Long, Bob. Nevada State, Division of Forestry.

Martin, Jim. District Manager, Douglas County Sewer Improvement District No. 1.

Martin, Richard L. Superintendent of Schools, Douglas County School District.

McDowell, Robert. U.S. Forest Service, South Lake Tahoe.

McDowell, Scott. Nevada Museum of Natural History.

Milam, Ken. Director, El Dorado County Planning Department.

Miller, Scott. Nevada Museum of Natural History.

Morris, Frank. U.S. Environmental Protection Agency.

Mross, George. Assistant Superintendent and Administrative Coordinator, Douglas County School District.

Nevada Public Service Commission.

Noble, Douglas. El Dorado County Planning Department.

Oliver, William. California Public Utilities Commission.

Orsak, Larry. Xerxes Society, Department of Entomology.

Panik, Dr. Howard. Western Nevada Community College.

Penzl, Anne. Nevada Museum of Natural History.

Pike, Patty. Sierra Pacific Power Company.

Pinzl, John. U.S. Bureau of Land Management, Carson City, Nevada.

Randall, Brian. Office of the Nevada State Engineer, Division of Water Resources.

Randolph, Stan. California Air Resources Board.

Reed, Sherry. U.S. Forest Service, South Lake Tahoe.

Rich, Charles. California State, Solid Waste Management Board.

Ross, Vern. Nevada State, Division of Environmental Protection.

Ryser, Fred. University of Nevada, Reno.

Saake, Norman. Nevada State, Department of Fish and Game.

Sanford, Fred. Supervising Sanitarian, El Dorado County Division of Environmental Health.

Sawyer, Andrew. California State Water Resources Control Board.

Scribner, James. Placer County Public Health Department.

Smith, Doc. Douglas County Building Department.

Smith, Fred. Nevada State, Department of Fish and Game.

Smith, Raymond. Consultant on Douglas County, Nevada General Plan.

Smith, Warren. El Dorado County Sheriff Department.

Stoms, David. U.S. Forest Service.

Stout, Paul. Southwest Gas Corporation.

Swing, Jack. California State, Department of Health, Office of Noise Control.

Thomason, William. Health Planning and Human Resources, Nevada.

Turnbeaugh, Leonard. Alpine County, Department of Public Works.

Vostrez, John. California Tahoe Regional Planning Agency.

Wagner, Richard. California State, Department of Fish and Game.

Weidmer, Curt. Director of Health Services, El Dorado County.

White, Charles. California State Water Resources Control Board.

Wickwire, Russell. California State, Department of Fish and Game.

Widby, Tad. California Tahoe Regional Planning Agency.

Williams, Jere. Creegan & De'Angelo, Consulting Engineers.

Willis, John. Petrolane.

Wright, Robert E. Deputy Attorney General, California.